A History of the Doctrine of Cerebral Localization

Second Part: Methods and Main Results*

WALTHER RIESE† and EBBE C. HOFF†

IN THIS second part of our history of the doctrine of cerebral localization we have again abandoned the conventional method of recording fact by fact and stage by stage the progress made in our subject. Instead, we have endeavored to present a critical and constructive review of the basic facts and principles and, particularly, of our present state of knowledge in the light of history. The completeness of the historical report may have suffered from this method, but our primary purpose is a didactic and not solely a narrative one.

In the first part of this study, we endeavored to show that the doctrine of cerebral localization, though a chapter of modern medicine, is a legitimate child of the doctrine of the seat of the soul. The latter, an old product of human thought, was presented systematically for the first time by Descartes. As such it already contained the germs of the doctrine of cerebral localization. While in Descartes' doctrine of the seat of the soul a local presence of the soul still conflicted with its universal presence, any regional residence was definitely denied to the soul by Kant, who also restricted the soul's presence to a "virtual" one, namely, through *virtus,* i.e., force or activity. Kant also set a limit to our localizing efforts which have to be restricted to *physiological* processes. The crude brain-materialism of the nineteenth century favored an unlimited cerebral origin of mind processes becoming substitutes for the soul. In the emphasis placed on movement as the only element of thought admitting of a correlation with the brain, Henri Bergson contributed much to a re-establishment of a rational doctrine of cerebral localization.

Though the principle of cerebral localization is a most general one, excluding no division of the brain from its application, the major anatomical, physiological, and clinical studies devoted to our doctrine have centered around cortical localization. This holds true particularly for the initial and the so-called classical period of the history of the doctrine.[1] Privilege was

* For First Part, see this *Journal,* 1950, *5,* 50–71.

† Medical College of Virginia, Richmond.

[1] A group of Berlin neuroanatomists and brain pathologists who met informally in the first decades of this century called itself "Die Hirnrinde" (The Cortex).

given to the study of voluntary motor power, to the cortical area related to it (the so-called motor area), the pathway entrusted with the task of conveying its impulses (the pyramidal tract), and its functional deficiencies (paralysis). It was only in the twenties of this century that more attention was given to the correlation of the *sub*cortical structures with a group of nervous functions and symptoms brought to the fore by the discovery of new diseases and their after-effects (Wilson's disease, encephalitis lethargica, and postencephalitic conditions). To the historian the sources of this increase in our knowledge are of great interest, springing, as they do, from the *incidental* appearance of an epidemic and the investigations inspired by this epidemic. Equipped with these new experiences, contemporary observers rediscovered the past. Parkinson's "Shaking Palsy" and similar extrapyramidal diseases were restudied in the light of the newly gained insight into the physiology and pathophysiology of the extrapyramidal system and reclassified according to anatomical-pathological principles. Those who have lived through this most recent period of modern neurology will not hesitate to trace the revival and enrichment of our actual knowledge of the subcortical structures as a whole (comprising the basal ganglia, the hypothalamus, the cerebellum, and the brain stem as their major elements) back to the years when the sudden outbreak of epidemic encephalitis on the European continent disrupted the traditional line of brain research. The bulk of our present-day knowledge of cortical localization, insofar as it stood the test of time, repeated observation, and reasoning, was written before that time and is therefore not of recent origin.

The shift in interest from one region of the brain to another is a most remarkable phenomenon in the history of the doctrine of cerebral localization. It seems that each division of the central nervous system—spinal cord, cortex, basal ganglia, cerebellum—has had its heroic age. Once a given cerebral structure comes to the fore, sometimes by pure accident, it is explored from all sides and with all methods, and no author wants to stand aside. It is true that because of this collective interest and study, our factual knowledge increases; but all too frequently to the cerebral structures usurping available interest, an all-importance is given. One sees again and again in the course of the history of our subject that more enlightenment is expected from one single region than could be furnished by the whole. At present, we live in the age of the hypothalamus, though signs of twilight and decline are already evident. If we were less driven by our greediness for facts and discoveries, we would not only better master the immeasurable quantity of our factual knowledge, but would also avoid monotonous repe-

tition of the same errors and faults committed by each generation ever since the problem of cerebral localization began to be attacked one and a half centuries ago.

The historian, of course, realizes that the shift in interest is a major history-making factor, and the history of medicine can even be written in terms of the ever-changing subjects seized by the doctrine of diseases throughout the ages. But what distinguishes former periods from our time is that the shift of interest always sprang from the doctrine and the view of human nature under normal and pathological conditions. Whether dogmatists, empiricists or methodists, whether humoralpathologists or solidarpathologists, whether vitalists or physicochemists, iatromechanists or iatrochemists, they were never primarily concerned with collecting facts, but with gaining insight into the natural phenomena of life and death, health and disease. We still live under the dictates of our predecessors that medical systems have to be condemned. Such a contempt of the achievements of centuries of investigations and reasonings seemed timely in the nineteenth century. One wonders whether the time has not come to rediscover the systems and the truths they contained, without, of course, reiterating and reviving a past written in its own terms and on the grounds of its own experiences.

All branches of neuroanatomy contributed to our increasing knowledge of cerebral localization. It is the purpose of *comparative neurology,* the foundation of which is linked with the names of Edinger, Elliot Smith, Johnston, Ariens Kappers, Judson Herrick, and others to compare the brains of different species with one another and to detect the particular distinctness and development of a given structure in those species whose functions and behavior make this structure understandable in the light of a greater need. Such, at least, was the method used in the Frankfurt Neurological Institute, under the guidance of Edinger, Wallenberg, and Goldstein. It was traditional to link on comparative grounds cerebral localization with broad biological views. A similar method was used in *neuroembryology* and the comparative embryology of the brain. Various stages of brain development were compared with one another and related to functional stages they might suggest or explain. In the course of history comparative methods used in comparative neurology as well as in comparative embryology of the brain progressed from the study of the brain as a whole to that of lobes, fissures, convolutions, and finally to that of the histological constituents of the central nervous system, i.e., nerve cells, neurofibrils, myelin sheaths, and synapses. To the historian this change in method reflects the

general march of methods in the course of the history of our anatomical knowledge from the great bodily regions to the organs (Morgagni) and finally to the tissues (Bichat). We are still at the latter stage. The interpretation of all these comparative studies implies some critical reasonings and pitfalls; indeed, oversimplifications cannot always be avoided. A most salient one is the assumption that a given nervous structure or organ plays the same functional rôle in different species. The hypothesis that an isolated structure is the counterpart or the measure of a given behavior (always implying the activity of the whole) is another one.

Brain pathology furnished specimens in which a given structure or system was lacking, destroyed, or diseased. This material not only admitted of a study of structural interrelations, secondary degenerations, and compensatory hypertrophies, but it also provided the student of nervous function with models of correlation of known functional disturbances with well-defined lesions and their effects on the rest of the brain. In ***experimental neuropathology*** secondary degenerations were produced at will. A major part of our knowledge of nuclei and pathways, becoming more and more relevant to the *neurosurgeon,* came from the study of these secondary degenerations. A special place must be assigned in the entirety of neuroanatomical methods and studies to cytoarchitectonics, i.e., the study of the minute structures and structural variations of the mammalian cortex. The first discoveries in the field we owe to Meynert (1867). But the list of authors who laid the foundation of cytoarchitectonics comprises also the names of Hammarberg, Elliot Smith, Campbell, Brodmann, and von Economo. Here are the basic facts, results of eighty years of cytoarchitectonic research.

A. Anatomical Localization

1. *Cytoarchitectural Localization*

The historian of medicine has no difficulty in relating the cytoarchitectonics and the decomposition of the cortex into numerous distinct areas to Gall's doctrine of the faculties and their seats. One reads with great satisfaction that at the meeting of the Académie Impériale de Médecine, May 2, 1865, Parchappe in a way anticipated cytoarchitectonics as a justification for Gall's doctrine. At least, he expressed his surprise that Gall himself did not furnish the necessary *anatomical* proof for his system:

> Il est singulier que Gall, tout en perfectionnant l'anatomie du système nerveux par d'importants travaux, qui constituent son titre scientifique le plus glorieux, n'ait pas fait porter ses recherches sur les points qui eussent précisément pu servir à vérifier

la légitimité de son système, s'il avail pu démontrer que la périphérie des hémisphères cérébraux se décompose effectivement en organes distincts, correspondant anatomiquement aux fonctions physiologiques distinctes dont il admettait l'existence.[2]

Today, the cerebral (neo-) cortex of the adult is finally seen to be composed of six different cell layers, each of them characterized by a predominant cell type (pyramidal cells, granular cells, spindle cells). This basic tectogenetic type, established by Brodmann, undergoes regional variations. Of these, the most important are due to an increase or a decrease in the number of layers, the fourth, lamina granularis interna, being primarily involved in this process. As a final result, the whole neocortex has been divided into several hundred cytoarchitectural areas. According to many writers these areas are true *organs*. The absolute number of areas, however, to which a definite functional rôle could be assigned on the ground of physiological experiments is very small.

a. *Descriptive results.* Cytoarchitectonic studies made a new and most valuable contribution to our knowledge of the finer structure of the cerebral cortex. In some instances, the fundamental six-layer type is obvious only during embryonic life. Another type never shows the six-layer structure but only a reduced or rudimentary cortex, practically identical with the olfactory region. This distinction proved to be a most useful principle of classification of cortical organizations.

b. *Comparative results.* The fundamental six-layer type is also called "neocortex" because of its increasing development in the mammalian brain, especially in man. Again, it is the stratification which is submitted to variations as to number and extent of the cytoarchitectonic areas in the various groups of mammals. Since almost all of the great divisions of the mammalian group have been studied, a comparative anatomy of the cerebral cortex has to be written on a very large basis.

c. *Anthropological results.* A new access was opened in cytoarchitectonic studies by the examination of the brains of outstanding people, their physical and mental organizations, dispositions, efforts, and achievements having been more or less known and analyzed. Very few important conclusions have been reached since the number of specimens fulfilling the requirements for adequate investigation has been very small. Riese and Goldstein[3] have recently reported on a detailed morphological examination of the brain of Ludwig Edinger, pioneer of comparative neurology. This

[2] Parchappe, J. B. M. Discussion sur la faculté du langage articulé. *Bull. Acad. imp. Méd.* 1864–65, *30*, 679–703.

[3] Riese, W. and Goldstein, K. The brain of Ludwig Edinger. An inquiry into the cerebral morphology of mental ability and left-handedness. *J. comp. Neurol.*, 1950, *92*, 133–168.

brain exhibited a striking overdevelopment of the right cerebral hemisphere as reflected by convolutional and other criteria. Edinger was persistently left-handed. The overgrowth of the right hemisphere involved cortical areas which the authors have cautiously correlated with Edinger's special gifts in the visual sphere and productive thinking.

Neither the number nor the size of nerve cells can of themselves alone be admitted as sufficient criteria of psychic qualities, since the latter cannot be expressed in terms of space and spatial units and since morphology alone cannot do full justice to the time factor in mental processes.

d. *Neuropathological results.* The cytoarchitectural pattern can be submitted to a more or less *generalized* derangement involving the constituent cell layers in their entirety and limited or not to some definite areas, as for example in general paresis, Alzheimer's disease, and senile dementia. Or there may be a specific disorder involving *selective* destruction of one or more of the cortical layers (pathoclysis) as in Pick's disease. So a new path to the study of the cerebral cortex under pathological conditions has been opened, the so-called pathoarchitecture. The description of the pathoarchitecture of general paresis by Nissl and Alzheimer is one of the first fruits of this approach to the cerebral cortex.

e. *Functional results.* The various cytoarchitectural *areas* have been interpreted as functional units. Neurophysiology explored the cytoarchitectural fields for functional correlations and the areas were tested as to the functional responses they yielded on stimulation. The constituent cell *layers* of a given area were also submitted to selective excitation to examine their response as functional units. Dusser de Barenne and his co-workers, through the method of selective destruction of the cerebral layers by thermocoagulation, have given physiological meaning to the specific cell layers.

Cytoarchitectonic research yielded a large bulk of knowledge with a single and very simple method, namely, Nissl's stain of ganglion cells. By the metallic impregnation method of Golgi, Cajal, and others, important information about the destruction of neuronal processes, various cell types (not distinguishable with Nissl's method), and the connections between nerve cells could be obtained. According to Lorente de Nó,[4] no layer may be called "effector" or "receptor" or "associative" since nearly all of the layers contain afferent, efferent, and associative elements. The cortex is believed to be a unitary system composed of *vertical* chains of neurons. It is obvious that the nature of the boundaries of the various architectural areas is of primary importance for the problem involved. So far, no agree-

[4] Fulton, J. F. *Physiology of the nervous system*, 3d ed., New York, Oxford University Press, 1949. x, 667 pp. See pp. 288–312.

ment has been reached by the most competent investigators as to the existence of sharp or melting boundaries. As examples, we may contrast the concept of rigid localization of the Vogts with the flexible and dynamic interpretation of von Economo. We face the same difficulty in delimitation when we consider the areas explored by physiological experiment. Thus, the sensory and motor manifestations elicited from the cortex extend far beyond the classical cytoarchitectonic areas.

2. *Myeloarchitectural Localization*

The cerebral cortex of the adult is composed of several layers of myelinated fibers of different origin, course, caliber, and thickness. Here, too, regional variations occur. Although many of these are still unknown, a considerable portion of the cortex has been "mapped" according to myeloarchitecture. Historically outstanding are the results obtained by this method by the Vogts and their co-workers.

3. *Vasoarchitectural and Glioarchitectural Localization*

Similarly, vasoarchitectural research has shown that there are vasoarchitectural areas, delimited from one another, the difference between these areas being a difference in the number and size of vessels. There are also variations in the blood supply according to layers. This vasoarchitecture runs parallel with the cytoarchitecture. Glioarchitectural research has revealed variations of the glia, especially of the macroglia, according to layers and areas.

As a whole, the results of all these architectural studies are not in proportion to the painstaking efforts made over a period of more than half a century. They have supplied a more appropriate anatomical model for the age-old struggle to correlate nervous function with nervous structure. On the other hand, they have also exposed us to the great temptation of expressing nervous and even psychic functions in terms of brain maps and charts, and many a scientist did not resist this temptation, using (though unwittingly) the new methods and knowledge for a revival of the doctrines of Gall and the phrenologists.

Recently cytoarchitectonic studies have been submitted to severe criticism by Lashley and Clark[8] as to methods as well as to their functional significance. These authors have attacked the reliability of the criteria applied in the numerous attempts to map the mammalian cortex and the validity of the finer architectonic subdivisions as areas of functional specialization. Here are some results of this critical investigation, inspired by the

[8] Lashley, K. and Clark, G. The cytoarchitecture of the cerebral cortex of Ateles: a critical examination of architectonic studies. *J. comp. Neurol.*, 1946, *85*, 223–305.

failure to confirm a majority of the areas of the (iso)cortex differentiated by previous investigators. The characters by which the loci have been distinguished are unrelated to their constant functions (such function being executed by structures which are submitted to variations). These writers raised the question whether the differentiation of areas which are consistently different, yet different in respect to no constant character, might not be due to accidents of development, local accelerations, or retardations of cell division and growth in especially susceptible regions, occurring at different stages of development and so affecting different elements. Without exception, they concluded, students of architectonics have depended primarily upon an intuitive judgment of the nature and amount of difference between areas. Except for the boundaries of area 17 and the caudal margin of the precentral agranular cortex, the indeterminate zone between distinguishable regions is too great to justify the drawing of any sharp boundaries. Between different individuals of the same species and between different species the uncertainty of identification and delimitation of areas increases still further.

B. Physiological Localization

1. *Electrical Stimulation*

Innumerable efforts have been made to delimit functional areas of the cerebral cortex yielding characteristic motor responses on electrical stimulation. Functional charts of the human and mammalian cortex are the results of these efforts.

According to Haller and Zinn, Longet, Magendie, Flourens, Matteuci, van Deen, Eduard Weber, and Budge, the cerebral hemispheres were believed to be inexcitable. The well-known discoveries of Fritsch and Hitzig (1870) and Ferrier set an end to this dogma. It is most significant that Hitzig considered his own work as a confirmation and continuation of Bouillaud's attempt to localize speech; Hitzig obviously did not realize the fundamental difference between speech and electrically induced movements. He repeatedly referred to the presumptive site of psychic functions as the final object of his endeavour. Since 1870 a vast body of literature has been developed concerning the responses to electrical stimulation of the cerebral cortex in various species and the human being. Among these studies, the investigations of Sherrington and his co-workers, C. and O. Vogt, Foerster, Penfield, and Fulton and his co-workers stand out prominently.

It has now become an integral part of our teaching that there is *no rigid*

localization of electrically elicited motor responses.[6] There are not only *individual variations* in the functional topography of the motor cortex as well as differences between the right and the left motor regions of the same individual, but electrical stimulation in itself does not yield a constant effect. There is a functional *instability* of the motor points. The motor response of a given point varies considerably according to *previous stimulations.* As a matter of fact, the result of an electrical stimulation may be submitted to local or distant *facilitation,* it may be *reversed* or *deviated.* There may even be *extinction* of the effect when the stimulation succeeds a previous one after a long interval. *Multiplicity* and *overlap* of representations are other features of experimental stimulation. A motor field mapped at a given moment by a series of stimulations will not be identical with the motor field mapped at another moment by another series of stimulations. One conclusion to be derived from these facts is that *the functional topography of the excitable cortex has to be expressed not only in terms of space but also of time.* Indeed, there is also a difference of excitability according to life periods; it is generally difficult in the infant macaque to obtain the characteristic motor response of the adult motor region, namely, isolated movements. In a three-week-old monkey, area 4 is the only region from which responses are elicitable and they are less discrete and of slower onset than in the adult.[7,8]

[6] According to Foerster, the following major factors are involved in the effect of electrical stimulation:

(1) Individual *threshold values* according to the intensity of the current necessary to provoke a motor reaction.

(2) Individual *qualities of the current,* some areas reacting only to faradic, others to faradic and galvanic stimulations, the quality of the response (ordinary or tetanic) depending on the current applied.

(3) Individual *behavior of the areas in anesthesia,* which suppresses the excitability of a given area either by both electrical currents or by one of them. There are also differences in behavior according to the type and depth of the anesthesia.

(4) Individual behavior as to the quality of the motor responses, some areas yielding *isolated* movements, contractions of a group of muscles, of a single muscle or even of parts of a single muscle, others yielding *massive* movements (synergies).

(5) Individual behavior as to the occurrence of *subjective sensations* on stimulation.

(6) Individual behavior as to the *character of epileptic seizures,* the discharge generally having an effect similar to that produced by the electric stimulation of the same area.

(7) Temperature, blood supply, shock, flow of cerebrospinal fluid.

[7] Kennard, Margaret A. and McCulloch, W. S. Excitability of cerebral cortex in infant Macaca mulatta. *J. Neurophysiol.,* 1942, *5,* 231–234.

[8] The effects of electrical stimulation of the prenatal cortex of the monkey have also been studied (Hines, Marion and Boynton, E. P. The maturation of "excitability" in the precentral gyrus of the young monkey [Macaca mulatta]. *Carnegie Instn. Wash. Publ.,* 1940, No. 518, 309–451). Two types of movements thus elicited have been distinguished: movements lacking discreteness or topographical localization are called "holocinetic," while movements bearing a direct relation to the topographic localization of parts within the precentral gyrus are called "idiocinetic." The former is believed to be the nonpyramidal, the latter the pyramidal type of movement. The holocinetic type was obtained before birth in fetuses of 66 to 125 days' gestation age, while the idiocinetic type was noted in fetuses of 135 to 162 days' gestation age. As maturation proceeded, silent regions became reactive and holocinetic points gave place to idiocinetic points. Before birth the results of stimulation of the corti-

The experimental fact that the response elicited from an excitable area can be facilitated or suppressed subsequent to stimulation of other cortical regions, as shown by Dusser de Barenne and his co-workers, demonstrates the co-operative activity of these cortical regions and sets another limit to the local and focal element.[9] It has already been stressed by von Monakow that *extra*-Rolandic regions contribute to excitatory and inhibitory processes, and that the precentral gyrus is not simply a local depository of motion; and thus is made possible an orderly and appropriate sequence of movements required for intentional acts. Furthermore, sensory symptoms can be obtained by stimulation (strychninization) not only of the sensory cortex proper (postcentral gyrus), but also of the motor area (precentral gyrus). On the other hand, the postcentral convolution in its turn has proved to be excitable under certain conditions. Thus, there is *overlapping of sensory and motor fields. The same cytoarchitectural area may mediate different functions.* Finally, anticipating the subject of the next paragraph, it may be mentioned that tactile stimulations of various areas of the skin (by displacement of a few hairs) can be related to regional potentials in the postcentral gyrus (in the monkey), but the *type* of representation thus established is not that of a *regional* projection but of a *dermatomal* one.[10] The legitimate conclusion to be drawn from all these experimental facts is that *there are several functional plans of the cortex which may or may not be co-extensive with the structural* (*cytoarchitectural*) plan. But most important for the whole problem of localization of nervous function is the fact that *the types of movements resulting from electrical stimulation of the human cortex are rather fragments of movements than well-organized functional units* such as seen in purposeful voluntary acts.[11] Again, this

cal surface bore little relation to observed activity (isolated movements believed to be the "cortical" type of movements were not observed but obtained by stimulation). During the first two weeks of postnatal life a closer correspondence between observed activity and the elicitation of movement by cortical stimulation was obtained.

[9] Stimulation of the so-called suppressor areas produces suppression of cortical electrical activity, reduction in electrical excitability, sudden cessation of spontaneous muscular activity, and relaxation of muscular contractions. (Bucy, P. C. The neural mechanisms of athetosis and tremor. *J. Neuropath. exp. Neurol.*, 1942, *1*, 224–239.) Experimental evidence has been recently presented urging that the phenomenon of suppression is identical with the spreading depression of Leão and cannot be distinguished from it by any presumed criteria of differentiation. It is stated that the mechanism by which spreading depression is produced is essentially cortico-cortical, that it does not require neural continuity, but only neural contiguity. (Sloan, N. and Jasper, H. The identity of spreading depression and "suppression." *EEG clin. Neurophysiol.*, 1950, *2*, 59–78.)

[10] Reversal *en bloc* of the serial order of the cervical segments, overlapping of the cortical fields, and the assignment of the most distal portions as of those of greatest tactile acuity to the largest amounts of tissue are the three major elements of this entirely new organization of the sensory cortex. (Woolsey, C. N., Marshall, W. H., and Bard, P. Representation of cutaneous tactile sensibility in the cerebral cortex of the monkey as indicated by evoked potentials. *Johns Hopk. Hosp. Bull.*, 1942, *70*, 399–441.)

[11] Erickson, T. C. Electrical excitability in man. Chap. XIII, pp. 343–352 in: Bucy, P. C.,

supports the view von Monakow presented more than thirty years ago that a limited cortical field can yield no more than simultaneous and reflex-like effects.

2. *Electrical Potentials*

"Brain waves," discovered by Berger some twenty years ago and supposed to be discharged periodically by the cortical neurons, have been studied by an ever-increasing number of authors on a broad basis, and the various spontaneous and evoked patterns they show under physiological, pharmacological, psychological, and pathological conditions described in detail. Since we are dealing with cerebral localization, we are concerned here with the *regional* element in electroencephalography. The fact that the fundamental (alpha)rhythm comes from large areas in the occipital region, and to some extent from the frontal area as well, seems to imply such a regional element. It is now generally admitted that the electroencephalogram may be a valuable instrument for *localizing* diseased regions (tumors) of the brain because it may indicate a change in the character of the waves under these conditions. This means another regional element in the doctrine of electrical potentials. But it is significant that *the investigators of the electric activity of the cerebral cortex have had to face all of the problems involved in functional localization.* Do these rhythms involve the entire cortex? Or are they localized rhythms related or not to the cytoarchitectural areas? Is there a rhythm proper to the whole surface on which, however, discharges are superimposed in expression of functional activity of the cytoarchitectonic areas? In spite of their great significance for practical (diagnostic) purposes, the physiological meaning of these potentials is still not clear. Berger's alpha rhythm, however, appears only when the subject is at rest with attention relaxed and eyes closed; it is thus a "rhythm of inattention," or "a positive activity which fills those parts of the cortex which are for the moment unemployed."[12] One author assumes that where there is an electrical impulse, there is a nervous impulse, while another does not believe that most of the large regular electrical potentials one observes in neural masses prove the passage of nerve impulses. No hypothesis as to the true meaning of these waves can overlook the fact that they are subject to variations as to time, species, and individual and experimental conditions.

The method of recording the electroencephalogram has been combined with that of local strychninization (Dusser de Barenne and co-

Ed. *The precentral motor cortex.* Urbana, Ill., University of Illinois Press, 1944. xiv, 605 pp.

[12] Adrian, E. D. Rod and cone responses in the human eye. *Nature, Lond.*, 1944, *154*, 361–362.

workers).[13] A local application of strychnine to very small portions of the cortex induces typical changes in the electroencephalogram, namely, the temporary appearance of large and rapid potential fluctuations or "strychnine-spikes." The distribution of these spikes differs with the locus of strychninization. These specific differences in distribution are interpreted as the expression of direct relations between the various portions of the (sensory) cortex—of a functional organization within this region. But local strychninization of cortical areas "fires" (or depresses) not only the activity of other cortical areas, but also fires off certain subcortical gray structures (such as the thalamic nuclei). This combined method has become an instrument for the determination and analysis of *anatomical* systems by *physiological* methods, thus reversing the traditional march of reasoning and experimenting, according to which anatomy *precedes* physiology, though it does not invalidate the principle that if preference is given to physiology, the latter should not be studied *without* anatomy.

3. *Ablation*

Experimental ablations of parts of the brain were first made systematically by Flourens (1823). The astonishing result of his studies was that sensation and volition decreased in proportion to the *amount* of tissue removed, regardless of the *region* destroyed. It took almost half a century to substitute for Flourens' hypothesis the now undisputed doctrine that the site of the destruction is not without influence on the type of the resulting functional disorder. The contemporary reader is impressed with the fact that in the beginning the same disorders were not only conceived as motor in nature (paralysis) by eminent investigators, but also as sensory by other physiologists and clinicians (Nothnagel, Schiff). Nor did the phenomena of restitution, which did not escape the attention of the pioneers of cerebral localization using ablation experiments, speak in favor of the localizing principle. The modern history of total and partial extirpation of the brain starts with Goltz and Munk. These two names reflect at the same time two opposite results and interpretations: Goltz conceived the disturbances in motion and sensation resulting from cortical destruction as mostly transient and not correlated with distinct areas, while Munk was definitely localistic. To the historian it remains most significant that Munk considered cerebral localization to be a "physiological postulate"[14] even before he was able to

[13] For complete bibliography see: Bucy, P. C., Ed. *The precentral motor cortex.* Urbana, Ill., University of Illinois Press, 1944. xiv, 605 pp.

[14] Munk, Hermann. *Ueber die Funktionen der Grosshirnrinde: gesammelte Mittheilungen aus den Jahren 1877–80; mit Einleitung und Anmerkungen.* Berlin, A. Hirschwald, 1881. x, 133 pp.

prove its exactitude. For didactic reasons, let us limit ourselves to a critical review of the results of ablation of the so-called motor area. It is not our intention to record all the innumerable facts yielded by the exploration of the brain by means of removals. We are interested only in the history and development of the *doctrine* of cerebral localization, and the principles implied in this doctrine can be fully treated in a consideration of the motor region. It is self-evident that the interpretation of removal of areas related to sensation or even so-called higher psychic functions remains open to speculation in animal subjects. Only a given behavior, i.e., a complex of movements, is open to objective study and it is only in terms of behavior that we can analyze and evaluate sensation and psychic phenomena in experimental animals. Munk's famous discoveries of cortical deafness and mind-deafness, resulting from bilateral excision of well-delimited zones of the temporal lobes in the dog, represent a case in point. To Munk, we owe also the first experimental demarcation of the visual sphere in the occipital lobes of the dog, as well as the knowledge of cortical blindness and mind-blindness. Nor can we omit reference to the work of Jacobsen and co-workers on the disturbed behavior of primates following prefrontal lesions.

A century of research in the effects of excision of small and large portions of the cerebral cortex has yielded the now classical result that ablation of a given area is followed by a specific functional deficit, the integrity of this area being considered as indispensable for the undisturbed function. The well-known effects of the ablation of the motor area, i.e., paralysis and loss of skilled movements, have been the most instructive examples of regional representation. However, in evaluating the results of experimental removal of cortical areas the following factors are of decisive importance: The functions lost by ablation are susceptible to some *restoration*. It can now be said that the amount and degree of residual defects may be relatively insignificant in some precentral lesions in experimental animals. Removal of the representation of the extremities from the precentral motor cortex in man results in an immediate complete flaccid paralysis of the part or parts represented, this paralysis being temporary, with recovery in four to sixteen days after the operation (P. C. Bucy).[15] Removal of the hand area in man results in loss of skilled and delicate movements of the fingers, possibly open to training. Again, effects of ablation have to be interpreted not only in terms of space (areas), but also of time.

Similarly, the *age* factor has to be taken into consideration, ablation of

[15] Bucy, P. C., Ed. *The precentral motor cortex*. Urbana, Ill., University of Illinois Press, 1944. xiv, 605 pp.

the motor and premotor areas in infancy having less effect than removal of the same areas from older animals (Kennard).[16, 17, 18] This has also been expressed by stating that the infant cortex has a greater capacity for reintegration of motor activity than has the cortex of the adult.

✓ Schemes of Cerebral Localization Conceived on Clinical Grounds

The first most primitive and most debatable scheme of cerebral localization was the "punctate" or "point-to-point" localization of nervous function. It was adopted on the largest scale and for a long time was the uncontested equipment of the so-called classic doctrine of cerebral localization. That the *factual* evidence does not favor this type of cerebral localization has been stressed recently by Walshe.[19] He presents as a major element of his criticism the fundamental observation that in hemiplegia single movements may be paralyzed but never a single muscle alone. There is some variance between the clinical and experimental evidence of this point, however. The constituent logical elements of this scheme of cerebral localization, the *reasoning* which is at the source of its conception, have never been discussed. No doubt its keystone is the famous idea of a "center." But what is a center? The abundant use physiologists and neurologists made of this idea strangely contrasts with the relative lack of any systematic effort to analyze the concept. We must go back to the time of the foundation of the classic doctrine of cerebral localization to discover the matrix of the modern concept of center. Hitzig's work on the excitability of the cortex inaugurated a new epoch. It was unfortunate that he did not limit his conclusions to the method used and to the results yielded by this method, but crossed the border of electrophysiology to invade psychology and even metaphysics. Most significant in this respect were his polemic remarks, intended to defend his position against Goltz, whose critical sense was to the greatest benefit of a reasonable and sober principle of cerebral localization, though it did not find the general approval and the followers it deserved. Hitzig concluded from his experiments that the soul could not be, as Flourens and his followers believed, a kind of *total* cerebral function. The movements

[16] Kennard, Margaret A. Reorganization of motor function in cerebral cortex of monkeys deprived of motor and premotor areas in infancy. *J. Neurophysiol.*, 1938, *1*, 477–496.

[17] Kennard, Margaret A. Cortical reorganization of motor function; studies on series of monkeys of various ages from infancy to maturity. *Arch. Neurol. Psychiat., Chicago*, 1942, *48*, 227–240.

[18] Kennard, Margaret A. Reactions of monkeys of various ages to partial and complete decortication. *J. Neuropath.*, 1944, *3*, 289–310.

[19] Walshe, F. M. R. *On the contribution of clinical study to the physiology of the cerebral motor cortex.* Victor Horsley Memorial Lecture. Edinburgh, E. & S. Livingstone, Ltd., 1946. 32 pp.

elicited by electrical stimulation of certain cortical regions, the paralysis of the same muscles after destruction of the same cortical regions, the failure to influence motor function by stimulation or destruction of other regions taught him that the cortical areas are not equivalent. As far as the methods applied were concerned he was right (though the results in the hands of the British neurophysiologists proved to be far less simple than Hitzig believed). But nothing entitled him to conclude from these stimulations and ablations that "certain and perhaps all psychic functions need well-defined cortical centers for their entrances into matter and their exit from it." Once again, the doctrine of the seat of the soul and of the brain as its "immediate organ" had found its way into medical thought.

The terms most frequently used and implying some, though rather vague, idea of the rôle assigned to a center, are *projection, representations,* and their *connections* and *associations.* Obviously, the term and mechanism of projection, left to the elementary motor and sensory processes, in itself does not imply any functional element; the concept is intrinsically a *spatial* one and it was only logical to make its spatial nature clear to the student by linking it with the adjective geometrical. What is evidently meant by the term and the mechanism involved is a kind of photographic reproduction of the bodily surface and of external objects, though on a minuscule scale. It was inevitable that with increasing knowledge of the parts projected and their mutual spatial relations, the picture of an imaginary homunculus must emerge, a kind of double which we harbor on the cortical surface of our brain, but nevertheless different in shape and size from the original.

That no kind of projection, reproduction, or homunculus can give a true picture of our own body and the external objects seems to be less conspicuous in sensory experience than in movement. We are indeed subject to the error of conceiving our sensations as static, thus apparently admitting of a point-to-point correlation with the central structures. But that our sensations, normal and pathological, are but the final result of an evolutionary, i.e., chronological process, has been shown by Henry Head.[20] Thus far, there is no basic difference between motion and sensation, both being processes in space and time. Therefore, *no type of cerebral localization which would not do justice to both space and time as to the indispensable elements of the world we experience can reflect the full picture of our internal and external experiences.*[21] Projection alone cannot do this. A rational scheme

[20] Head, Henry, and others, *Studies in neurology.* London, H. Frowde; Hodder and Stoughton, 1920. 2 vols.

[21] This has also been stressed by Lashley, though in somewhat different terms. Lashley, one of the very few contemporary neurologists who

of cerebral localization must also provide for the evolutionary or chronological nature of projected things. This leads us to a consideration of Jacksonian and contemporary types of cerebral localization.

Hughlings Jackson[22] was one of the very few nineteenth century neurologists who strove for a precise analysis and interpretation of terms such as representation, center, and localization. He used *representation* synonymously with *co-ordination,* which he made the basic mechanism of the central nervous system. Since he admitted only physiological processes as susceptible of localization (rejecting any dealing with mentality), coordination was understood to be an orderly *sequence* of physiological processes. This statement implied in Hughlings Jackson's principle of cerebral localization gives access to one of the fundamentals of his entire doctrine, namely, that *movements and not muscles or parts of the body are represented in the brain.* The representation of movements he believed to be multiple and overlapping, one area, however, being the area of preferred representation of a given movement. Spreading convulsions can be explained, he said, in the light of this multiple representation, and restoration of nervous function after limited destruction must be explained by the still remaining units of representation. His principle of localization was indeed a very generous one, since he claimed a wide field for representation of movements, namely, the entire motor cortex within which each movement is represented innumerable times. Although Hughlings Jackson distinguished between types of movement, according to their more or less automatic or voluntary nature, he did not consider corresponding types of localization. According to his doctrine, each movement, though represented many times, is in itself always represented separately and distinctly, regardless of its type. It was left to von Monakow[23] to distinguish between primi-

reject the conventional scheme of cerebral localization on the ground of experimental facts as well as of critical reasoning, believes, however, that there is evidence for separate localization of the mechanisms for "serial timing," or the "temporal order of activity." (Lashley, K. S. Functional determinants of cerebral localization. *Arch. Neurol. Psychiat., Chicago,* 1937, *38,* 371–387.) The difference between this type of localization and chronogenic localization is to be seen in the fact that the latter does not entrust one part of the brain with the timing factor and still other parts with factors regulating intensity of response or spatial orientation, but that it rejects any localization of any phenomenon requiring time for its appearance or reappearance. In the light of the doctrine of chronogenic localization the brain is believed to be the structural counterpart of the history of nervous function, which, though modified, is retraced in the brain at any moment a given nervous function is reactivated. In other words, in chronogenic localization, there is no special cerebral provision for what is time and temporal order in our acts; they are all chronological (except the synchronic reflexes), their temporal nature is a universal one, proper to all of them, and thus, it cannot be left to one area of the brain exclusive of the rest. Moreover, in relating "timing" to one area alone, we are endangered to "spatialize" time and to deprive it of its very nature.

[22] Jackson, J. Hughlings. *Selected writings.* London, Hodder and Stoughton, 1931–32. 2 vols.

[23] Monakow, Constantin von. *Die Lokalisation im Grosshirn und der Abbau der Funktion durch kortikale Herde.* Wiesbaden, J. F. Bergmann, 1914. 1045 pp.

tive, synchronic, or reflex-like movements and those which (like our skilled and refined acts) are successive, require training and presuppose history and evolution. While he admitted (though somewhat reluctantly) well-defined areas for the former, he denied categorically to the latter any local representation, relating them not only, as Hughlings Jackson did, to the entire *motor* cortex, but to the cortex *as a whole*. Here it is not movement in its entirety which has its multiple representation but its several components, belonging to different chronological "layers," and affecting widespread regions of the cortex. Von Monakow did not hesitate to consider the entire cortex as a motor cortex. But if any evolved function, such as a refined movement, must be understood to have an omni-representation, what is the rôle of the specialized structures we are driven to relate to specialized functions? In spite of omni-representation, von Monakow admitted of some local accentuation of the physiological processes underlying purposeful and refined movements. The idea took shape definitely in Goldstein's assumption that the well-known central structures are determining factors in what he called the "figure formation," a basic function of the central nervous system.[24] The central nervous system, he taught, acts always as a whole, but to each special performance corresponds an excitatory state of its own, characterized by a regional "elevation" of the total dynamic process. We do not consider this contribution of the structures to the whole a fixed one, limiting the range of performances and subduing them to the structures. One might venture the assumption that the rôle of the structures, even the most specialized ones, is a flexible one, according to past, present, and future condition.[25, 26, 27]

Two Noteworthy Clinical Examples Illustrating the History and Principles of Cerebral Localization

James Parkinson's "Shaking Palsy"

Paralysis agitans may be selected as an excellent example for the demonstration of the type of progress made in neurology under the influence of the neuroanatomical approach implied in the doctrine of cerebral localization. The historian will realize that our actual knowledge of this condition has made but little fundamental progress since its first description by James

[24] Goldstein, Kurt. *The organism*. New York, American Book Company, 1939. 533 pp.

[25] Riese, W. Principle of integration; its history and its nature. *J. nerv. ment. Dis.*, 1942, *96*, 296–312.

[26] Riese, W. Principle of evolution of nervous function. *J. nerv. ment. Dis.*, 1943, *98*, 255–266.

[27] Riese, W. Principle of compensation of nervous function. *J. nerv. ment. Dis.*, 1944, *100*, 263–274. See also *Principles of neurology in the light of history and their present use*. The Nervous and Mental Disease Monographs. New York, 1950.

Parkinson in 1817. In his "Essay on the Shaking Palsy" the author, imbued with a profound clinical erudition, drew the full picture of the disease, citing as its major symptoms "involuntary tremulous motion with lessened muscular power in parts not in action and even when supported; with propensity to bend the trunk forwards, and to pass from a walking to a running pace; the senses and intellects being uninjured." To these basic disturbances Parkinson added the observation that the patient is "irresistibly impelled, due to the propensity, to take much quicker and shorter steps," a sign to which the French clinicians much later gave the name of "marche à petits pas." Parkinson also mentioned the speech disturbances in paralysis agitans; he identified them with previous observations of Gaubius who in his turn related them correctly to "accelerated motion" (the tongue "outruns the mind"). Parkinson, however, considered the speech disorders to be due to a "loss of the power of articulation" (thus not distinguishing them sharply from true aphasia, practically unknown at his time). Furthermore, he mentioned salivation. It is true that he did not mention rigidity (and the "plastic" resistance); but in discussing speech disturbances (the "volubility"), he referred to Sauvages' theory of a "want of flexibility in the muscular fibers." He did not describe the well-known pill-rolling, the retropulsion, the difficulty experienced by the patient to initiate and to stop a movement, the general paucity of movements (akinesia), the slowness in execution of movement (bradykinesia), the lack of expressive and associated movements producing the mask-like faces, the infrequency of blinking, and absence of swinging movements of the arms in walking.

Leaving aside the still unknown etiology of the idiopathic Parkinsonism and its still unsuccessful treatment, the main progress made by modern neurology concerns our knowledge of the neuroanatomical and neuropathological nature of the disease, which we now classify with the diseases of the extrapyramidal system. At the time of Parkinson, neurology (inasmuch as it existed) was still essentially a clinical science; the neuroanatomical and neuropathological discoveries were still to be made. But should we not admire the profound foresight of a clinician who not only insisted upon the peculiar type of tremor (as a rest tremor and not an intentional one) as on the discriminative character of shaking palsy, but who also concluded that this "species" of tremor "may assist in leading to a knowledge of the seat of the disease?" He did not neglect *chorea Sancti Viti* as a condition closely allied to paralysis agitans. Modern neurology now relates these (and similar) involuntary movements to the extrapyramidal system (the basal

ganglia). Parkinson, of course, could not know that the voluntary motor power is conveyed by the pyramidal system, which is not involved in pure extrapyramidal diseases. But he emphasized the relative integrity of voluntary movement in paralysis agitans: "The dictates of the will are, even in the last stages of the disease, conveyed to the muscles; and the muscles act on this impulse, but their actions are perverted."

The History of Aphasia

The history of aphasia[28] has been told by Henry Head.[29] It has been retold by Weisenburg and McBride.[30] The early story of aphasia has been traced by one of us.[31] It is not our intention to write the history of aphasia again here. We rather wish to follow the general lines along which the study of aphasia has developed during a century, and to analyze the effects this study had on the doctrine of cerebral localization, its different versions, applications, and present usefulness. *The history of aphasia can indeed be written in terms of a passage from a disturbed isolated "faculty" to a specific behavior lacking, it is true, elements proper to undisturbed speech, but not lacking specific and even new ways of expression, thus not lacking integration and consequently being a total behavior.* In its beginning the doctrine of aphasia was linked with the doctrine of the faculties into which Gall decomposed mental life, each of these faculties being related by him to well-defined areas of the brain. This view of the aphasic was first victorious (though not uncontested), until Hughlings Jackson opened a new era by appealing to superior (propositional) and inferior (emotional) speech as to attitudes the individual as a whole may assume or lose. This does not mean that the doctrine of the faculties and their seats has been completely abandoned; it still has many followers. Nor does it mean that it had no opposition to meet in the pre-Jacksonian period. The history of aphasia was so closely related to the history of cerebral localization that it necessarily

[28] Instead of tracing sign by sign the history of the so-called focal symptoms, we selected aphasia as a test case. In the history of the doctrine of cerebral localization aphasia indeed played a dominant rôle. It was the first *clinical* fact which opened the era of localization on clinical grounds. The history of aphasia reflects all the problems raised by the principle of localization, and by tracing the history of aphasia we necessarily trace the history of clinical localization. The history of apraxia, agnosia, and other syndromes (the discovery, description, interpretation, and localization of which belong to a much more recent chapter of the history of types of behavior related to restricted areas of the brain) did not add any basic problem to the fundamentals laid down by a century of aphasia research.

[29] Head, Henry. *Aphasia and kindred disorders of speech.* New York, Macmillan Company, 1926. 2 vols.

[30] Weisenburg, Theodore and McBride, Katherine E. *Aphasia.* New York, Commonwealth Fund; London, Oxford University Press, 1935. 634 pp.

[31] Riese, W. Early history of aphasia. *Bull. Hist. Med.*, 1947, *21*, 322–334.

became involved in that dramatic discussion which brought to the stage as exponents of two conflicting principles the names of Gall and Flourens. This discussion is still going on, since there are still eminent physiologists setting in opposition to localization and the specific nature of limited areas an equipotentiality of cortical structures (Lashley).

Since the days of Hughlings Jackson there have been as many formulae of a "holistic" approach toward aphasia as there have been writers adopting it, some of them not being fully aware of the method they applied. But what can be enunciated as common to all of them is, first, the negative statement that neither undisturbed nor disturbed speech can be described or interpreted in terms of self-sufficient elementary mechanisms, faculties, or images. The corollary of this view is to be seen in the positive statement that in each language-function the individual acts as a whole, be it as an intact one or reduced by a brain lesion; the apparently elementary functions imply the activities of the whole individual. In Hughlings Jackson's terminology the holistic approach appears as the inability of the aphasic to "propositionize," a term difficult to grasp in its full extent, but obviously meaning a sequence of words related to each other according to rules, and thus conveying a definite thought. Single words, he said, are meaningless, and so is any unrelated succession of words. The unit of speech, he continued, is a proposition. He thus recognized the unifying and synthesizing function which is behind language and which betrays the true nature of our specifically human existence. The most general and far-reaching result of the Jacksonian interpretation is to be seen in the conclusion that speech, undisturbed or not, cannot be left to a mechanics of parts or elements (faculties, memories, images) but definitely emanates from a center of the individual holding together in its turn all parts and elements. From this inability to propositionize, a direct road leads to Henry Head's conception of aphasia as a disorder in symbolic thinking and expression. In this definition the most characteristic and most noble function of language is expressed, namely, being *representative* of inner states, needs, and concepts. Among the types of aphasia distinguished by Henry Head the semantic defect assumes the most general character. In this disorder of symbolic formulation, he said, the fault is essentially a want of recognition of relative significance and intention. Everything tends to be appreciated in detail, but the general significance is lacking. One might raise the question whether this variety can still be classified with speech defects. Henry Head himself speaks of a loss of power to appreciate or to formulate the logical conclusion of a train of thought or action. Perhaps less fortunate was Pierre Marie's

famous attempt to interpret aphasia proper as a lack of intelligence,[32] the term being too vague and requiring qualification, but conveying nevertheless a most general behavior. It is not so well known that similar interpretations of aphasia had been made previously by Trousseau, who wrote as early as 1868 that the aphasic has lost at the same time, though to various degrees, the memory of words, of the acts by means of which words are articulated, and intelligence. Leaving alone other contemporary attempts to interpret aphasia in the light of a disorder of basic functions (Bouman and Gruenbaum, van Woerkom), we finally quote Goldstein. Speech, he said, is one of the essential characteristics of human nature, inasmuch as it is tied to man's highest capacity, the capacity for abstract behavior. The latter is also called by him the categorical behavior, or the objectifying attitude, or even voluntary behavior. In the abstract attitude we are not directed toward an individual object but toward a category, of which that object represents itself only as an accidental example and representative of that category. To this behavior Goldstein opposed the immediate, concrete behavioral attitude, a more primitive one, in which the action is directly determined by momentary sense impressions in which we are directed rather toward the concrete thing in its particular uniqueness, and in which words are used less as representative of categories than as individual properties, which like other properties belong to the object in question. Due to the cortical lesion the (amnesic) aphasic is able to assume only the more concrete, the more realistic attitude. Not only speech, but also his general behavior is characterized by a greater concreteness (which Goldstein sees in the predominance of acting over thinking).

The interpretation of aphasia (apraxia, agnosia) in the light of a basic disturbance affecting the individual as a whole and all his manifestations (though to a different degree), necessarily leads to a drastic change in the traditional localizing efforts. Cerebral localization was understood to be the correlation of a given symptom with a lesion located in a given area (this correlation indeed involving numerous known and unknown contributing factors). But what remains of our principle if we must assume that limited cortical lesions never produce limited (but only total) functional disorders,

[32] Pierre Marie did not mean, however, that the aphasic is simply a demented person. The aphasic's intellectual deficiency, he said, is not a global one but "un déficit intellectuel très spécialisé s'appliquant non seulement au langage mais aussi à un certain nombre de notions acquises d'une façon didactique" (Marie, Pierre. Discussion l'aphasie. *Rev. neurol.*, 1908, *16*, 1032). To the sensory origin of aphasia (stressed by the classic authors) Pierre Marie opposed its intellectual one. It seems to us that a direct road leads from Pierre Marie's somewhat cursory analysis to Goldstein's interpretation of aphasia according to which the aphasic, when properly studied, reveals disturbances in all fields, the type of disturbance (loss of "abstract behavior") suggesting an "intellectual" one.

if what we call a given *symptom* is but the *expression of a general disorder*, and if the latter can be produced by any lesion regardless of its site? Still the fact remains that the basic disturbance (the de-differentiation of nervous function) affects one circumscribed performance field more than others, according to the part injured. *With the restriction in mind, that there are no truly "circumscribed" functional disorders, and that any circumscribed lesion throws into disorder basic functions of the brain, the principle of cerebral localization still remains a mighty weapon in our search for the site of brain lesions at the bedside of the patient.*

Another line of development and progress in aphasia research can be traced *from the assumption of speech centers as anatomical units to an all-embracing representation of speech in the brain.*[33] Once the so-called elementary functions, faculties, sound images, images of movement of articulate speech, memory images, kinetic memories, etc., had been established as the constituent elements of normal speech, one could indeed proceed to explain the various speech disturbances by loss of one or more of these elements. It was significant that this step was made by those clinicians who appealed to brain pathology as to the ultimate *ratio cognoscendi* of functional disorders. Surreptitiously, they used structural criteria in their interpretation of speech disturbances. Since each constituent element of speech was stored in a given area (center), the destruction of this area was linked with that of the corresponding memory image. The decomposition of speech into its presumptive elements can in itself not be made responsible for this view and for the imaginary schemes of aphasic mechanism, in which the famous "diagram makers"[34] indulged. From the viewpoint of

[33] Though neither the doctrine of cerebral localization as a whole nor that of separate centers imply in themselves a materialistic view of the interrelation of brain and mind processes, the student of the history and the actual use of these doctrines cannot escape the impression that, with rare exceptions, they have been linked with brain materialism. Formation and elaboration of language function have not only been left to various more or less independent centers, but function itself has been conceived as a kind of emanation of the anatomical structure to which therefore one is referred as to the final responsible agency. Thus, man has been understood to be determined and even enslaved by his brain. Most significant in this respect is the fact that one appeals to heredity to explain "left cerebral dominance," which seems to play such an important rôle in speech defects. The truly *autonomic* character of language as inherent to human nature has been almost entirely neglected in the literature of aphasia. It was von Humboldt who, a century ago, stressed this autonomic (*selbstaetig*) character of speech, the ignorance or negligence of which must prevent us from deeper insight into the formative processes and laws presiding over speech in the human race and the human child. Some kind of consciousness of this autonomic nature of human language however remained, education and re-education of speech indeed presupposing an active and spontaneous part played by the child and the patient, to whose efforts we appeal in training, leaving alone his brain and its hypothetical activity; in other words, we address the *individual* and not his centers.

[34] By analyzing the text of the first diagram of aphasia (made by Baginsky, Aphasie in Folge schwerer Nierenerkrankungen. Urämie. *Berl. klin. Wschr.*, 1871, *8*, 428–431; 439–443) we discover instantaneously the philosophical ideas on which diagrams were conceived. The author made it clear that he wanted to give a *mechanical inter-*

the history of human thought and of the genesis of doctrines, there was no necessity to pass from the presumptive constituent elements of normal speech (a subject of psychology) to their distribution over the brain surface (a subject of neuroanatomy). This second step was nothing but a revival of the doctrine of the seat of the soul (as of a local residence), so difficult to overthrow. Here follows an attempt to solve the problem raised by the admission of anatomical centers.

Though it is obvious that a given tissue can be destroyed, there is no evidence that ideas, thoughts, or memory-images (related or not to selective areas) may suffer the same fate. As a matter of fact, ideas cannot be destroyed, though human beings or parts of them "harboring" those ideas can easily be destroyed. But the organization of our intellect and our intuitive power provides no scheme for a destruction of thoughts or ideas. We are in danger of believing in such a destruction as soon as we isolate a given knowledge from the individual to whom it belongs. But there is no *retentum* having an existence of its own, independent from the individual who possessed it. Hughlings Jackson was the first to recall to the student of speech disturbances that there is *no absolute loss* of words or word images in the aphasic. To his qualifying statement that "there is no faculty of memory apart from things being remembered," we may add the following variant: There are no things remembered apart from the individual remembering them. It is of course true that an aphasic may have but fragments of his previous knowledge. But none of the retained fragments can be understood to be a fragment or self-sufficient offspring of the individual. (His "soul" is still everywhere in his body and in each of its parts in its entirety.) Each retained fragment of his previous knowledge still is the result of a fully integrated behavior. Neither can any *retentum* be destroyed nor stored in any particular part of his body or his brain. But what then is deficient in the aphasic's brain? Hughlings Jackson did not derive his conclusion (quoted above) from reasoning, but from the observation that the aphasic, far from being speechless, may have words "plentiful," according to the situation.[35]

pretation of mental processes; he hoped such an interpretation to be more successful than psychology had been so far. He distinguished centers for perception, memory, and concept formation. A concept was believed to originate from an association of at least two simultaneous sensations. No room was left to the synthesizing power of human mind and to formative agencies, which the writers of the early nineteenth century (von Humboldt) felt unable to neglect in any interpretation of human language. The memory centers of all sensory nerves send their pathways to the conceptual center which the historian quickly identifies with the *sensorium commune*. Thus, a mechanic view of language and thought, a total lack of formative and integrative actions, and a revival or survival of the *doctrine of the seat of the soul* were the constituent elements of the famous diagrams.

[35] As early as 1865 Bouillaud and Baillarger made similar statements. At the meeting of the Imperial Academy of Medicine, May 16, 1865, Bouillaud described the behavior of certain aphasics with the following words: "Dans les circon-

Similarly, Henry Head stressed the variability of the responses in aphasics, and Goldstein made this variability an essential element of an ever-changing "figure-background" process, characteristic of the organism. The variability of responses is most obvious in that type of aphasia the analysis of which yielded the most instructive and profound results, i.e., amnesic aphasia. A given name cannot be reproduced on request, but spontaneously in conversation or even on request at other occasions. It is impossible to explain this defect by the destruction of storehouses for words. Hughlings Jackson concluded that speech is no longer at the free disposal of the aphasic, that he does no longer command it at will. But what was more automatic in language was preserved, and this holds true particularly for all manifestations comprising a strongly emotional element. He distinguished this preserved automatic speech (as the inferior speech) from the superior (propositionizing) one. In so doing he revealed himself as an evolutionist of nervous function; as such he believed in a hierarchy leading from the most automatic and least voluntary to the least automatic and most voluntary. For an understanding of his views on cerebral localization it is of utmost importance to remember that he assigned the preserved functions to the spared or healthy parts, relating to the destroyed parts only what was really deficient. This distinction later became a guiding principle in Henry Head's studies on aphasia. According to Head there are unlimited clinical varieties of aphasia, due to the deficiencies of higher and the remaining activities of lower "centers." It is self-evident that voluntary speech requires a greater effort than automatic speech. The Jacksonian law that the loss of power to carry out an order depends upon the complexity of the task is but a corollary of his principle of dissolution, according to which the most difficult performances suffer first. This principle, however, should be used according to the significance of the terms, *easy* and *difficult*, and *automatic* and *voluntary* as applied to the individual case.[36] Jackson's rule that "the more abstract the conception, the more likely is the patient to fail in executing it" foreshadowed Goldstein's interpretation of the aphasic's failures as due to his inability to assume a categorical or abstract attitude. It was

stances ordinaires ils prononcent invariablement leur mot de prédilection, mais lorsqu'ils éprouvent un mouvement de colère, ils deviennent capables d'articuler un second mot, le plus souvent un juron grossier, qui leur était familier probablement avant leur maladie, puis ils s'arrêtent après ce dernier effort." (Bouillaud, J. Discussion sur la faculté du langage articulé. *Bull. Acad. imp. Méd.*, 1864–65, *30*, 724–781.) At the meeting of May 30, 1865, Baillarger expressed himself in similar terms: ". . . un certain nombre d'aphasiques retrouvent aussi quelquefois la parole lorsqu'ils sont sous l'influence d'une passion très vive." (Baillarger, J.-G.-F. Discussion sur la faculté du langage articulé. *Bull. Acad. imp. Méd.*, 1864–65, *30*, 816–832; 840–853.)

[36] Riese, W. Type, evolution and localization of aphasia following neuro-surgical relief in a 60 year old scientist, affected by paralysis agitans. *Confinia neurol.*, 1949, *9*, 216–225.

Hughlings Jackson who opened that new era in aphasia research which concentrated no longer exclusively on the functions lost, but which made the study and analysis of the retained functions a subject of primary importance. We are still in this era which carries the obligation *to look at the central nervous system of the aphasic not only as a fragmented one, but also as a new (though reduced) working unit, still admitting of a fully integrated behavior, though at a new level.*

C. von Monakow, unaware of Hughlings Jackson's work, called the defect in the aphasic a difficulty in *evocation* or recall, and he made evocation a principle of his *chronogenic localization.* He was of the opinion that various "chronological layers" laid down in the central nervous system at various developmental periods are revived at any moment, that the structural units in charge of the first elaboration of kinetic melodies would pass at any moment from a state of latency to actual excitation. Innumerable cortical areas, far distant from one another, would be active again and again in this revival, in ever-changing regrouping, and combined with other units used also for different functional purposes. Evocation, recollection, or revival are indeed most general and basic functions which cannot be left to any circumscribed area of the brain. Evocation of past impressions is permanently at work in our life; it guarantees the continuity of our existence and plays even a greater rôle in recognition than actual impression. In fact, we perceive only fragments of our objects which we rapidly identify with past impressions (due to recollection); this alone is recognition.

The sequence of events and the march of reasoning as outlined in this section can be summarized as follows: The writers who believed speech to be the result of activity of discrete centers constructed numerous schemes of aphasia based on the destruction of one or more of these centers and the conducting pathways uniting them. Thus, the well-known clinical varieties of aphasia took shape, true models of an "anatomical psychology," deriving clinical entities from (hypothetical) anatomical units and their connections. Those, however, who saw in speech the emanation of some basic power of the individual (or even of human nature), were of course hostile to any attempt to localize speech at distinct parts of the same individual. At best they could admit a functioning of the brain as a whole during speech. Although Hughlings Jackson outlined a scheme of cerebral localization (in which the inferior levels represent limited parts, whereas each center of the higher levels represents all parts of the body), he did not make any specific use of it when dealing with localization of speech. But he did not believe in "abrupt geographical localization." He did believe that very sudden and

very extensive damage to *any part* of the left cerebral hemisphere would produce *some* amount of defect of speech. In dealing with aphasia he did not deny his basic principle, according to which only *physiological* processes (movements) can be related to the brain. To him words remained "psychical things," concomitant with discharges of certain cerebral arrangements representing one or more articulatory movements. C. von Monakow developed this concept of a localization of intrinsically physiological processes on a broad basis. In his "chronogenic localization" the principle of cerebral localization became enriched by the time element. Each nervous function has a history of its own, and during its first elaboration and its repeated revivals and modifications, it necessarily appeals to widespread areas of the brain. Except for very simple, synchronic, and reflex-like mechanisms, *there can be no localization of any evolved nervous function in limited regions.* This holds true particularly for aphasia. But what then is the significance of those regions which, involved in a lesion, have proved since the time of Broca to be related to speech disturbances? The answer to this question leads to still other lines along which aphasia research has progressed.

In spite of the impossibility of localizing speech in well-defined regions, the "critical areas" of language retain their full significance. But they give at best support to a localization of *symptoms,* and not to a localization of *functions.* Aphasia (as well as apraxia and agnosia) is a symptom, i.e., a *disturbed* function. No one ever made or can ever make any observation as to localization of *speech.* Aphasia and not undisturbed speech is the object of localization. One is impressed with the fact that it took so much time and effort to recall this most elementary fact to the neurologist. It is no less an elementary fact that aphasia, conceived as a new, though disturbed way of symbolic thought and expression, cannot be related to structures destroyed; therefore, as far as the remaining speech of the aphasic is concerned, there is not even a localization of symptoms. Hughlings Jackson was the pioneer of the doctrine of localization of symptoms, succeeded by von Monakow and Goldstein. The number of contemporary brain pathologists who still cherish the idea of a localization of functions is small; Kleist is one of their outstanding representatives.

The effort to trace speech back to its presumptive constituent elements, and to relate them to limited areas of the brain, necessarily led to the establishment of as many types of disturbed speech as there were elements or connections disturbed. The result was a *classification* of speech disorders,

the divisions of which seemed always to increase in number (in 1906 there were already twenty-eight varieties); their names only too frequently betrayed their anatomical rather than functional or clinical origin, all of them confusing the beginner and often disappointing the expert who rarely succeeded in matching to his satisfaction the individual case with one of the entities the various authors and textbooks had to offer. The historian quickly realizes that he has to deal with *a modern version of ontological concepts of disease*. Though the names and discoveries of Broca and Wernicke represent the minimum of terms which no neurologist can ever renounce and no historian can neglect, it was an act of true liberation when Henry Head finally and resolutely declared that the clinical manifestations of the aphasic appear in terms of complex psychical processes, and that they cannot be classed under any physiological categories, motor or sensory, nor even under such headings as visual and auditory. Though it is true that he committed himself by a classification of his own, he wanted his reader to conceive this classification as a very flexible one. But the most radical conclusion at which modern aphasia research arrived was von Monakow's statement that *the clinical varieties of aphasia we were taught to distinguish are but stages succeeding each other during recovery* (or regression).[37] Once again von Monakow stressed the time factor in the analysis and interpretation of

[37] Only minor attention was paid to the problem of stages at the famous meeting of the Société de Neurologie de Paris, June 11, 1908 (*Rev. neurol.*, 1908, *16*, 975–1047). The questionnaire open to discussion contained the following topic: "L'aphasie motrice pure existe-t-elle d'emblée, ou n'est-elle que le réliquat d'une aphasie motrice complète, mais partiellement guérie?" Only three persons discussed it: Déjerine, Pierre Marie, and Souques. Déjerine admitted the possibility of an "aphasie motrice pure," succeeding an "aphasie totale améliorée progressivement." But "aphasie motrice pure" might well exist from the very beginning, and this was confirmed by Souques.

Henry Head was definitely hostile to fixed varieties of aphasia (though on grounds different from their interpretation as simple stages of restitution). In the famous discussion on aphasia (Proceedings of the Section of Neurology of the Royal Society of Medicine. Meeting held on November 11, 1920. Discussion on aphasia. *Brain*, 1920, *43*, 412–450) he was accused of being an empiric. He was delighted to hear it since, as he said, he wanted to follow the line of English empiric philosophy dating from Locke and passing into medicine through Hughlings Jackson. Henry Head's approach toward aphasia certainly was an enlightened example of an anti-ontologic method. He assumed that there were no such things as "types" of aphasia. He was so anxious to avoid any term recalling the famous medieval "faculties," their derivatives or clinical entities (such as "general understanding," "aphasia," "amnesia," "memory"), that he wanted even to refrain from using words such as "reading" and "writing" (which he declared to be only *a priori* conceptual terms), but "simply to observe what did actually happen." He probably did not know that his approach was essentially an Hippocratic one. A vast group of functions were employed in the acts called speaking, reading, and writing, and it was these which split up in certain ways to produce the clinical forms of disordered speech. Had he been bold enough, he asserted, he would have liked to have spoken of the "x group of functions" which broke up into the "a, b, c, and d groups." The need for such anonymous terms will indeed be brought home to anyone who wants to overcome the simplifications and premature generalizations implied in our current names and in the hypothetical or imaginary entities they express. Our terminology and our classifications should indeed be flexible and reshaped from time to time. (Riese, W. History and classification of nervous diseases. *Bull. Hist. Med.*, 1945, *18*, 465–512.)

aphasia and cerebral localization. Indeed, he admitted cerebral localization only with the qualifying restriction that localization should be understood to be a correlation of nervous function with nervous structure taking into full account the chronological nature of both. Von Monakow also emphasized the chronological element by his *fundamental distinction between temporary symptoms (due to neural shock or diaschisis) and residual symptoms which alone can be correlated with the area destroyed.*

The effect which the *elimination of the various types of aphasia as independent and self-sufficient entities* must have on localization is only too obvious. The ever-changing clinical manifestations can no longer be directly associated with static anatomical conditions in a restricted area of the brain. The most general result this analysis (made on the ground of factual evidence) yielded was that localizing efforts must be made with greatest caution. We should indeed never forget that a series of disturbed functions, a disease, is a sequence of events succeeding each other in the march of time, and that the regional element (the site of the lesion) is but one factor in the whole of chronological and spatial phenomena characterizing disease. As such, the regional element is an important factor and of greatest help to the physician and neurosurgeon; but it does not reflect the full picture of disease.

Reduced to their most simple expressions, the lines along which aphasia research developed during the course of one and a half centuries can be presented as *thesis* and *antithesis,* each making statements as to the psychological, anatomical, and clinical aspects of the subject. It would be most difficult to find an author holding the views of the thesis from its psychological aspect, but clinging to the antithesis from its anatomical aspect. More specifically, whoever believes in the thesis of distinct "faculties" is most likely to believe also in that of isolated "centers"; and he who believes in the antithesis of speech as an emanation of the total personality is most likely to believe also in a universal representation of the physiological processes underlying speech. Those who adopt the thesis of both faculties and centers are most willing to adopt the clinical thesis of distinct clinical entities of aphasia and most unwilling to adopt the antithesis of these varieties as simple stages through which the aphasic passes in recovery and regression. Gall, Bouillaud, Broca, Wernicke, Charcot, Nothnagel, Lichtheim, Bastian, Déjerine, Liepmann, Henschen, and Kleist are outstanding representatives of the thesis; Trousseau, Hughlings Jackson, Kussmaul, Marie, von Monakow, Head, and Goldstein are eminent exponents of the antithesis.

The Doctrine of Cerebral Localization as Applied to the Functions of the Autonomic Nervous System

In his concept that units or "convolutions" of the cerebrum represent movements of the whole body, Hughlings Jackson[38] included the conviction that not only movements so-called, that is to say, voluntary movements of the body, are represented in the cerebrum, but also that the movements of arteries and the viscera are so represented. In this he was not without forerunners. We have learned from a passage quoted by Cawadias[39] from Bordeu that this famous eighteenth century clinician and representative of the school of Montpellier believed that "functions first begin in the brain, which is divided into as many compartments as there are organs . . ." Jackson believed indeed that the very highest processes (the substrata of consciousness) are only the most multifold and complex of all sensorimotor processes, that they represent or re-represent all lower nervous centers and thus the organism as a whole. As early as 1869, Hughlings Jackson clearly stated that one must add to the constitution of the units of the cerebrum nerve fibers to the heart, blood vessels, and viscera "or rather probably to the regions of the sympathetic system, from which these parts are supplied." Hughlings Jackson arrived at the conclusion that the units of the cerebral hemisphere represent potentially the whole processes of the body—voluntary movements as well as activity of so-called involuntary structures. "The highest nervous processes are potentially the whole organism." This statement, however, should not be understood to be a revival of the old thesis that the autonomic nervous system establishes the unity of the organism. The error implied in this thesis was unfolded by one of us (W. R., 1949, pp. 125, 126).[40]

"The statement that muscle, viscera, etc., are represented in the 'organ of mind,' and in the very highest parts of that organ, at first glance appears extravagant," Hughlings Jackson said. However, he found it in general agreement with independent statements of Laycock, Bain, and Lewes. "Moreover," he added, "the seemingly extravagant statement accords closely with what disease shows. I wish to say that I have not arrived at the above conclusion by reasoning that since emotional phenomena are (on their physical side) widespread agitation of the limbs, viscera, and circula-

[38] Jackson, J. Hughlings. *Clinical and physiological researches on the nervous system. 1. On the anatomical and physiological localization of movements in the brain.* London, Low, Churchill, 1875. xlvii, 37 pp. (Reprinted in his *Selected writings,* London, 1931, *1,* 37–76.)

[39] Cawadias, A. P. Théophile de Bordeu: an eighteenth century pioneer in endocrinology. *Proc. roy. Soc. Med.,* 1950, *43,* 93–98.

[40] Riese, W. An outline of a history of ideas in neurology. *Bull. Hist. Med.,* 1949, *33,* 111–136.

tory organs, there *must* be a representation of these parts in the highest centres, but from observing that gross disease, tumours for instance, of 'the organ of mind,' produce muscular, circulatory, and visceral symptoms." Since Hughlings Jackson made the study of epilepsy the richest source of his observations and conclusions, we are not surprised that he drew particular attention to the autonomic events in the epileptic seizure. These, indeed, demonstrate the truth of the hypothesis that the highest nervous centers represent all lower nervous arrangements, and thus the whole body. The epileptic discharge begins in the very highest nervous levels with loss of consciousness. "Besides obvious convulsion, we have premonitory shivering, pallor of face, and increased flow of saliva, and in some cases, vomiting." Hughlings Jackson saw in the excessive and sudden discharge of these highest nervous levels "affection of the whole organism," its parts being disturbed nearly contemporaneously.

Hughlings Jackson's far-reaching hypothesis received its earliest experimental support in the neurophysiological findings of Maurizio Schiff,[41] who appears to have made the first direct observation that visceral activity can be modified by stimulation of the cerebral cortex. At the end of a paper published in 1875 on the motor functions of the cerebral hemisphere, Schiff drew attention to new experiments demonstrating that electrical stimulation of the cortex resulted in acceleration of the heart. In the same year, there was published a report by Danilewsky[42] describing rises in blood pressure evoked by stimulation of the cerebral cortex. Impetus for further experimental study came from Vulpian.[43] He had repeated the experiments of Fritsch and Hitzig and of Ferrier on motor responses from the cortex in a course of demonstrations in 1875, and he also became convinced that the cerebral cortex participated not only in the regulation of skeletal movements, but also in the integration of visceral activity. Speaking of the cortex, he stated: "Elle n'agit pas seulement sur les muscles qui font mouvoir les membres, le globe oculaire, etc., elle agit également sur l'appareil circulatoire, de même que sur l'iris, sur la rate comme sur l'intestin, sur la vessie et sur la sécrétion des glandes salivaires, etc. Pour s'en convaincre, il suffit d'opérer sur un animal incomplètement chloralisé. Au moment de l'excitation, on peut observer des mouvements des membres, du tronc, la dilatation de la pupille, l'augmentation de la tension artérielle, etc." In 1876, Boche-

[41] Schiff, M. Untersuchungen über die motorischen Functionen des Grosshirns. *Arch. exp. Path. Pharmak.*, 1875, *3*, 171–179. (Trans. by F. Borel from *Lezione sopra il systema nervoso encephalico*, Florence, 1874.)

[42] Danilewsky, B., Jr. Experimentelle Beiträge zur Physiologie des Gehirns. *Pflüg. Arch. ges. Physiol.*, 1875, *11*, 128–138.

[43] Vulpian, A. *Leçons sur l'appareil vasomoteur (physiologie et pathologie) faites à la Faculté de Médecine de Paris.* Paris, Germer-Baillière, 1875. 2 vols.

fontaine[44] published a detailed report of experiments on the curarized dog in which stimulation of the sigmoid gyrus was followed by a rise in blood pressure. These findings were confirmed and extended by Bechterew and Mislawski,[45] Stricker,[46] Cerevkov,[47] Howell and Austin,[48] Weber,[49] Dusser de Barenne and Kleinknecht,[50] and others. In recent years, a large body of experimental evidence has been adduced by Fulton[4] and his co-workers and others, establishing a representation at the highest levels of the central nervous system not only of the activity of the heart and circulation, but also of many other autonomic functions. This evidence is based on observations of the effects of stimulation of the brain and on results of experimental ablations (Kennard,[51] Pinkston and Rioch,[52] Watts and Fulton,[53] Sheehan,[54] Green and Hoff,[55] Green and Walker,[56] and others).

Further evidence for Hughlings Jackson's hypothesis is to be derived from the symptoms of autonomic imbalance seen in disease or injury of the human brain. The studies of Chevallier in 1867, who found temperature differences between the limbs of the paralyzed side and the normal side of the body in patients with hemiplegia, were the beginnings of a large series of observations of localized and generalized autonomic disturbances following cerebral lesions (Gubler, Nothnagel, Rossolimo, Peritz, Kahler, Bergler, Meinz, and others).[57] Goldstein's classical studies[58] of patients with war injuries of the brain have particularly emphasized the important rôle of

[44] Bochefontaine, L. T. Étude expérimentale de l'influence exercée par la faradisation de l'écorce grise du cerveau sur quelques fonctions de la vie organique. *Arch. Physiol. norm. path.*, 1876, *8* (sér. 2), 140–172.

[45] Bechterew, W. von and Mislawski, N. von. Ueber den Einfluss der Grosshirnrinde auf den Blutdruck und die Herzthätigkeit. *Neurol. Zbl.*, 1886, *5*, 193–195.

[46] Stricker, S. Untersuchungen über die Gefässnervencentren im Gehirn und Rückenmark. *Med. Jb.*, 1886, *1*, 1–19.

[47] Cerevkov, A. *Ueber den Einfluss der Gehirnhemisphären auf das Herz und auf das Gefässsystem.* Harkov, Guseff, 1892. 176 pp.

[48] Howell, W. H. and Austin, M. F. The effect of stimulating various portions of the cortex cerebri, caudate nucleus and dura mater upon blood pressure. *Amer. J. Physiol.*, 1899, *3*, 22.

[49] Weber, E. Einwirkung der Grosshirnrinde auf Blutdruck und Organvolumen. *Arch. Anat. Physiol.* (Physiol. Abt.), 1906, *30*, 495–508.

[50] Dusser de Barenne, J. G. and Kleinknecht, F. Ueber den Einfluss der Reizung der Grosshirnrinde auf den allgemeinen arteriellen Blutdruck. *Z. Biol.*, 1924, *82*, 13–20.

[51] Kennard, Margaret A. The cortical influence on the autonomic nervous system. In: Bumke u. Foersters *Handb. Neurol.*, 1937, *2*, 476–491.

[52] Pinkston, J. O. and Rioch, D. McK. The influence of the cerebral cortex on peripheral circulation. *Amer. J. Physiol.*, 1938, *121*, 49–54.

[53] Watts, J. W. and Fulton, J. F. Intussusception—the relation of the cerebral cortex to intestinal motility in the monkey. *New Engl. J. Med.*, 1934, *210*, 883–896.

[54] Sheehan, D. The effect of cortical stimulation on gastric movements in the monkey. *J. Physiol.*, 1934, *83*, 177–184.

[55] Green, H. D. and Hoff, E. C. Effects of faradic stimulation of the cerebral cortex on limb and renal volumes in the cat and monkey. *Amer. J. Physiol.*, 1937, *118*, 641–658.

[56] Green, H. D. and Walker, A. E. The effects of ablation of the cortical motor face area in monkeys. *J. Neurophysiol.*, 1938, *1*, 262–280.

[57] Hoff, E. C. The role of the cerebral cortex in the central nervous regulation of cardiovascular function. *Confinia neurol.*, 1949, *9*, 166–176.

[58] Goldstein, K. *After effects of brain injuries in war. Their evaluation and treatment. The application of psychologic methods in the clinic.* New York, Grune and Stratton, 1942. 244 pp.

complaints pointing to disturbances within the autonomic nervous system and Goldstein has distinguished two groups of symptoms in such cases: those autonomic disturbances affecting the body as a whole and those limited to circumscribed parts of the body. Goldstein's studies were particularly directed toward vasomotor disturbances.

The effect of cerebral cortical stimulation on visceral activity is the subject of a continuing experimental investigation in the Laboratory of one of us (E.C.H.),[59] and recent evidence reveals that the elevation of blood pressure produced by stimulation of the cortical pressor regions is associated with a redistribution of blood within the kidneys and other visceral organs as well as the limbs. Moreover, these responses may be facilitated by local strychninization and show other neurophysiological characteristics of somatic motor responses evoked by cortical stimulation.[60]

The experimental and clinical observations briefly reviewed here strongly suggest that the central nervous system, including its highest nervous elements, is concerned not only in the movements of skeletal muscles but also in the activity of structures supplied by the autonomic nerves.

[59] Hoff, E. C., Kell, J. F., Jr., Hastings, N., Gray, E. H., and Sholes, D. M. Acute renal cortical ischemia produced by stimulation of the pressor area of the cerebral cortex. *Fed. Proc.*, 1949, *8*, 76.

[60] Hoff, E. C., Langford, H. G., Vester, J. W., Beckner, W. W., and Thomas, P. R. Facilitating effect of local strychninization on pressor responses evoked from cerebral cortex. *Fed. Proc.*, 1950, *9*, 61.

A History of the Ferret

ALEXANDER P. D. THOMSON*

ALTHOUGH ferrets have in all probability been tamed for considerably more than two thousand years, their early history in the service of man, like that of most other domestic animals, is obscure. This is due partly to the scarcity of written records and partly to difficulties of identification. Vernacular names for the animal frequently vary from district to district, while ancient scientists may have added to the confusion by incorrect translations from one language to another.

As far as can be told, Aristotle, about 350 B.C., gave the earliest description of an animal which might have been a ferret, although Aristophanes had mentioned a similar animal in one of his comedies about one hundred years before in relation to its use at Boeotian feasts. The Greek word 'ictis,' as used by these two writers, is sometimes translated 'ferret' and sometimes 'polecat.' Among various authorities who imply that 'ictis' means 'ferret' are Ray (1693), Buffon (1812), and the editors of the *Oxford Junior Encyclopaedia* (1950). On the other hand Gesner (1551) maintains that 'ictis' is 'polecat,' which he says is very similar to the ferret, while Taylor (1809) translates 'ictis' as 'polecat' without admitting any alternative meaning. The following is Taylor's translation from the relevant paragraph from Aristotle:

> With respect to the polecat, it is an animal of the size of a small dog of Malta; but in the thickness of its hair, its form, and the whiteness of its belly, and, also, the craftiness of its manners, it resembles the weasel; and becomes very mild and tame. This animal, however, is injurious to bee-hives, for it delights in honey. It, likewise, eats birds in the same manner as cats. But its genital parts are bony, as we have before observed; and the pudendum of the male appears to be a remedy against the strangury; for which purpose the scrapings of it are given.

It may be inferred from these references that the animal, whether ferret or polecat, was well known to the ancient Greeks, for it is unlikely that Aristophanes would have used an obscure animal in his ironical allusions to the neighbouring Boeotians. A significant aspect of Aristotle's description is the statement that the animal could become very mild and tame—an obvious reference to a close association with man.

While it is unfortunate that Aristotle did not record the purpose for which the animal was tamed it could hardly have been used for hunting

* Birmingham, England.

rabbits since these animals were unknown to the ancient Greeks (Daremberg & Saglio, 1887). However, some later Greek and Roman writers describe rabbit-catching animals which, again, might have been ferrets. Thus Strabo (63 B.C.?–? 24 A.D.) and Pliny (23–79 A.D.) recorded that a plague of rabbits on the Balearic Islands was hunted with ferrets. It is worth giving translations from these two writers as they are often quoted, sometimes wrongly, in connection with the origin of the ferret.

Strabo, in a description of Spain (Book III.2, 6), writes:

> But there are scarcely any destructive animals, except the burrowing hares, by some called "peelers"; for they damage both plants and seeds by eating the roots. This pest occurs throughout almost the whole of Iberia [Spain] and extends even as far as Massilia [Marseilles], and infests the islands as well. The inhabitants of the Gymnesian [Balearic] Islands, it is said, once sent an embassy to Rome to ask for a new place of abode, for they were being driven out by these animals, because they could not hold out against them on account of their great numbers. Now perhaps such a remedy is needed against so great a warfare (which is not always the case, but only when there is some destructive plague like that of snakes or field mice), but, against the moderate pest, several methods of hunting have been discovered; more than that, they make a point of breeding Libyan ferrets, which they muzzle and send into the holes. The ferrets with their claws drag outside all the rabbits they catch, or else force them to flee into the open, where men, stationed at the hole, catch them as they are driven out. (Jones 1803)

This early account of rabbiting appears to be the basis of the belief that ferrets originally came from North Africa.

Strabo's thumbnail sketch of rabbit hunting was repeated a few years later by Pliny (*Historia naturalis,* Lib. VIII.55) thus:

> There is also a species of hare, in Spain, which is called the rabbit; it is extremely prolific, and produces famine in the Balearic Islands, by destroying the harvests. . . . It is a well known fact, that the inhabitants of the Balearic Islands begged of the late Emperor Augustus the aid of a number of soldiers, to prevent the too rapid increase of these animals. The ferret (*viverra*) is greatly esteemed for its skill in catching them. It is thrown into the burrows, with their numerous outlets, which the rabbits form, . . . and as it drives them out, they are taken above.

Although some translators of Strabo and Pliny use the word 'ferret,' there are several reasons why the animal referred to might not have been the creature we know today: (a) not all translators infer that the animals in question were ferrets—Wolters, 1707, used the word 'felis' signifying a cat or polecat; (b) many of the animals in the weasel group will attack and destroy rabbits; (c) others of them can be tamed—polecat (Buffon 1812, Harting 1891, and others)—weasel (Buffon, cited by Harting 1898, and English, cited by Millais 1905)—*Mustela siberica* (Swinhoe 1861); (d) the weasel group has an extensive geographical distribution (Miller

1912); (e) the evidence that the ancestral ferret existed in North Africa derives entirely from (i) Strabo, and (ii) hearsay evidence of the presence of wild polecats, e.g., in the Rif (Cabrera 1930), and in Libya (information supplied in reply to questions submitted to H.M. Consular Offices Tripoli by the present author). On the other hand, it is probably true that tamed ferrets are to be found in North Africa (Shaw 1738, and Cabrera 1930). But it may well be that the conditions which prevailed when ferrets were first domesticated no longer exist either in North Africa or elsewhere; and (f) Thomas (1901) omitted to mention ferrets among the fauna of the Balearic Islands.

On the other hand, the creatures mentioned by Strabo and Pliny were obviously employed in much the same way as modern ferreters use their animals, e.g., they were bred specially for the purpose, and muzzled before being sent into the rabbit burrows. Perhaps these details are important in establishing that the Balearic islanders did in fact hunt with ferrets, although it is possible that a similar description could apply to the use of any member of the weasel family tamed to catch rabbits. There is no doubt, however, that when the idea became known by the Middle Ages that ferrets (or some animal akin to them) could be used for rabbiting, the habit spread throughout Europe, Asia, and probably also the Far East.

The Romans are sometimes credited with the introduction of ferrets into Britain, but no reliable evidence has been found to support that belief. Whitaker (1773) asserts that "when the Romans introduced the rabbet into Italy and Britain they brought the same custom of attacking it with ferrets." If he based his statements on the references he gave (viz. Strabo p. 214* and Pliny Lib. VIII.55), then he is in error, for neither of these writers mentioned or implied that ferrets (or rabbits, for that matter) were introduced into Britain in Roman times. Actually references to their presence in Britain are later in time than are those concerning the Continent.

Isidore of Seville (560?–636 A.D.) gave an account of what was probably a ferret (as shown by descriptions of later writers). He named the animal *furo* because it was thievish (Latin *fur,* a thief) and it was employed in rabbit hunting. This short reference to the ferret is important because it shows that the classical Latin term 'viverra,' used by Pliny, had been replaced by a low Latin word which now provides the basis of subsequent identification of the ferret in written records. These are of particular interest to us in Anglo-Saxon and Old English documents.

In the eighth century Egbert, Archbishop of York, founded a library

* J. Wolters' edition of Strabo's Geographia (1707, p. 214) contains Book III.2, 6.

TABLE I

SOME LATIN, ANGLO-SAXON, AND OLD ENGLISH NAMES APPLIED TO FERRETS*

Century A.D.	*Latin*	*Anglo-Saxon*	*Old English*	*Source*	*Authority*
1st	viverra			Pliny, Lib. VIII	Bostock & Riley, 1855
6th–7th	furo			Opera omnia	Isidore of Seville
8th	furuncus	meard		Anglo-Sax. vocab.	Wright, 1884
10th	furunculus	mearp		Anglo-Sax. gloss.	Wright, 1884
10th	furunca and ferniculus	meard		Archb. Alfric's vocab.	Wright, 1884
11th	furo, furuus, furniculus, and fur	mearp		Anglo-Sax. MS.	Wright, 1884
11th	feruncus	meard		Anglo-Sax. vocab.	Wright, 1884
13th	furo, furectus, furunculus			Opera omnia	Albertus Magnus
14th	ferrettus			Pat. Roll, 1384, 318 m 6.	Turner, 1901
14th			fyret	Statute, 13 Rich. II	Harting, 1888
14th			fyrette	New English Dictionary	Murray, 1901
15th	furo		foret	Pictorial vocab.	Wright, 1884
15th	furniculus		fferet	Latin-Eng. vocab.	Wright, 1884
15th	ferutus		forytt	A nominale	Wright, 1884
16th	viverra, furo, furunculus, furuus, furectus, etc.		feret, ferrette	Histor. animal.	Gesner, 1551
16th			firette	Book of hawking (Vele)	Hodgkin, 1907
16th			ferret	Book of hawking (Allde)	Hodgkin, 1907
17th	furo, viverra			De quadruped, etc.	Aldrovandus, 1645
17th	furo, viverra		ferret	Pinax rerum, etc.	Merret, 1667
17th	furo, viverra, furunculus		ferret	Synopsis meth., etc.	Ray, 1693

* For further examples of variations in spelling of 'ferret' see *New English Dictionary* (1901) and J. Hodgkin's *The Book of St. Albans, 1481.*

which contained works by Aristotle and Pliny, and among the studies cultivated at York were "the natures of man, cattle, birds and wild beasts: their various species and figures" (Turner 1823). It is reasonable to suppose therefore that the use of ferrets for rabbiting was known to early Anglo-Saxons. This appears to be borne out by an examination of Anglo-Saxon-Latin vocabularies where the low Latin word *'furo'* (or some other derivative of the root *fur*) occurs from the eighth century onwards. Yet before the eleventh century the equivalent Anglo-Saxon word is 'meard' or 'mearp,' whereas the word 'ferret' (or some recognisable variation) does not appear in English until the fourteenth century (Table I). It is apparent that Anglo-Saxon and Continental authorities identified the animal 'furo' with the animal 'meard' up to the eleventh century, after which the animal 'furo' was the 'ferret.' The word 'meard' vanishes at the end of the Anglo-Saxon period. It is of interest to note that a Frankish form of the Anglo-Saxon word 'meard' exists in modern English as 'marter' or 'marten' (*New English Dictionary,* 1901) and that translation of 'meard' from Anglo-Saxon documents into modern English is rendered, not as 'ferret,' but as 'marten,' e.g., Alfred's account of a voyage by Ohthere, translated by Turner (1823), and Ross (1940).

It may also be significant that references to and illustrations of the use of ferrets for rabbiting in Britain do not appear until the fourteenth century (Fig. 1). In 1384 Richard II granted a sporting license to one of

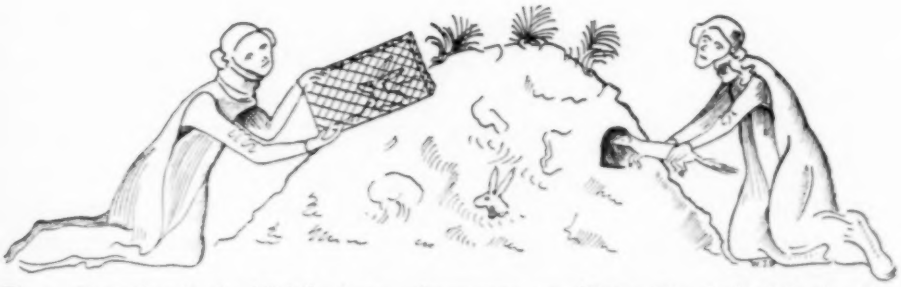


Fig. 1. Ferreting in the Middle Ages—about 1300 A.D. (From *The Oxford Junior Encyclopaedia,* 1950, Vol. IX).

his clerks allowing him to hunt rabbits with ferrets (Patent Roll 318, m. 6, of 16th Feb. 1384, quoted by Turner 1901). The same monarch issued a Statute about the year 1390 prohibiting the use of ferrets ('fyrets') on Sundays (Harting 1888).

Together these facts may indicate that ferrets as known today were unknown to the Anglo-Saxons and that the animals first made their ap-

pearance and were first used for rabbiting in England after the Norman Conquest when possibly the rabbit was brought contemporaneously to these islands. Further support is given to that idea by the etymology of the word 'cony' (the first reference in English being said to occur in the thirteenth century—a century *before* the appearance of 'ferret' [*New English Dictionary,* 1901]) and the suggestion that the English word 'ferret' was without doubt borrowed from French through the language of the chase (*Dictionnaire Etymologique de la Langue Française,* Block, O. and Wartburg, W. V., Eds., 1932).

Whether or not there were ferrets in Britain before 1300, their presence on the Continent was fairly accurately described by Albertus Magnus, a German, who wrote in the thirteenth century:

> The Gauls call it *furo* or *furunculus* or *furectus*. It is a small animal, larger than the weasel, between white and yellow in colour. It is both fierce and brave, and drives out rabbits from their holes into nets. It is hostile to all animals, either on account of anger as some say, or because of blood which it drinks, yet it does not eat flesh. It is indeed fertile, sometimes seven or even nine young may be born. It is said to copulate lying down. The female in heat and lacking the male will swell up and die. The gestation period is forty days. Up till thirty days the young cannot see and when they are aged seventy days they can hunt. . . .

Two other thirteenth century references to ferrets show how widely distributed the animals were in Europe and Asia. In the winter of 1221 Genghis Khan, conqueror of North China, India, Afghanistan, and much of the Middle East used ferrets in an imperial hunting circle at Termed. (It is almost certain that Termed is the present-day town of Termez located just north of Afghanistan.) It was apparently an ancient custom to organise hunts on a gigantic scale like military operations. From every direction soldiers drove entire animal populations from a huge tract of land into a small area where the animals were eventually slaughtered. Such a hunt might last several months, and as the circle grew smaller and smaller, the driven beasts retreated into holes and burrows "but spades, mattocks and ferrets brought them out" (Ranking 1826).

About this time, too, ferrets were being used in Germany. They were included in a list of animals used in hunting by Emperor Frederick II in 1245 (Schneider 1788, quoted by Harting 1898).

In the middle of the sixteenth century we find a description and illustration of the ferret by Gesner (1551) (Fig. 2). His account makes it clear that there was considerable confusion as to the origin, identification, and names applied to the various weasels then known. However, he quite clearly separates them into two groups. The first he calls *Mustela domestica* because the animals in this group were to be found in the neighbourhood

of dwelling houses. The other he calls *Mustela sylvestrys,* and in it he includes an animal which was employed for catching rabbits. If Gesner's transcriptions from ancient authorities are to be trusted, there would appear to be no doubt that the animal which Strabo said was brought from Africa into Europe for rabbiting was indeed the ferret, and that the same animal was used for this purpose in Gesner's time. On the other hand, there was also a view that ferrets were to be found in the wild state in England where they were reported to be easily captured and tamed—presum-

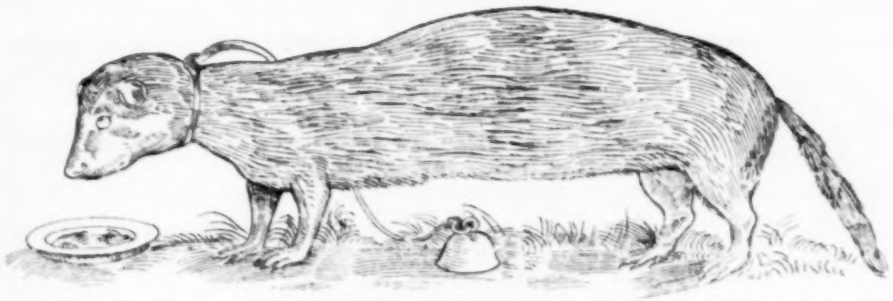


Fig. 2. The Ferret, after Gesner, 1551.

ably to catch rabbits: ". . . in Anglia enim hoc genus sylvestre reperiri audio: tamen facillime cicuratur, & domi capsis quibusdam ligneus alitur, . . ." Indeed the wild variety was itself hunted in order to limit the depredation of rabbits which it carried out on its own account. Gesner expresses surprise that wild ferrets could be found in England in view of the fact that Strabo had said that the animal had been originally introduced in a domesticated state from Africa. Presumably if Gesner had known that ferrets had been introduced into Britain at the time of the Roman conquest it is likely that he would have mentioned it, if only to explain the occurrence of the wild variety. But he makes no such reference. Perhaps he, too, was confusing 'furo' with the Anglo-Saxon 'meard.'

Gesner's whole account is interesting. He gives many synonyms for the animal and enters into long textual arguments concerning their origins. He gives an extensive account of the folklore relating to ferrets and repeats Aristotle's remedy for strangury. He also states that the animal was used by French nobles for rabbiting, particularly in the province of Narbo, and that the first ferret he saw was at Nimes.

About a century later Aldrovandus (1645) repeated most of what Gesner had already written about the ferret without material addition.

Meanwhile the ferret had been mentioned in several English works: the Authorised Version of the Bible (1611); the household books of Lord

William Howard of Naworth Castle in Northumberland; and some books on hunting (e.g. Tuberville 1575). In the Bible the ferret is listed among the unclean animals (Lev. XI. 29 and 30):

> These things shall be unclean to you among the creeping things that creepeth upon the earth; the weasel and the mouse, and the tortoise after its kind, and the ferret and the chameleon, and the lizard and the snail and the mole.

There would appear to be some ground for believing that the word 'ferret' is a misnomer, and that some other animal was meant, but not all the arguments in favour of this view are convincing; for example, it is said that the ferret does not creep, yet the inclusion of the weasel in the above quotation is not questioned (*vide* Tristram 1868; Wood 1876; and *Encyclopaedia Biblica* 1901).

Out of all the apparent uncertainty of ancient times and of the Middle Ages the identity of the ferret began to emerge clearly when Merret (1667) named it "Viverra, Ictis, Furo, a Ferret." Ray (1693) named the animal "*Mustela sylvestris,* VIVERRA dicta, The Ferret" allowing three synonyms—furo, furunculus, and ictis. Ray repeated the statement that the animal was thought to have come from Africa, and that it had been introduced subsequently into Britain giving, without detail, D. Willughby as the authority. It was not until Linnaeus (1758) named the ferret *Mustela furo** that its identity became established finally. Since then, the question has not been so much one of identity, but one of discussion as to whether the ferret is a distinct species, or merely a variety of a wild polecat. The general view today is that they are the same.

SUMMARY

The early history of the ferret is obscure. Its first description, as far as can be told, was made by Aristotle in the fourth century B.C. About 350 years later Strabo gave an account of perhaps the earliest use of the animal for rabbiting. Strabo refers to the taming of Libyan ferrets and this appears to have been interpreted to indicate that the ancestral ferret originated in North Africa. Apart from a belief that wild ferrets were to be found in England in the sixteenth century (Gesner 1551) and in North Africa in the twentieth century (Cabrera 1930), no other reference to the occurrence of ferrets in the wild state has been found.

There is no reliable evidence to show that ferrets were introduced into Britain at the time of the Roman invasion. Rather it would appear that the

* Miller (1912) stated (in error) that Linnaeus, *Systema Naturae,* 1758, ed. 10, Vol. I, p. 46, named the ferret *Martes furo*. Pocock (1932) made the same mistake.

animal was first introduced and first used for rabbit hunting in Britain between the eleventh and fourteenth centuries, although it can be inferred that the ferret and its use were known to the Anglo-Saxons through the writings of Continental scientists, particularly Aristotle and Pliny.

There is little doubt about the identity of the ferret, as used for rabbiting, from about the thirteenth century, when it appears to have been widely used for this purpose in Europe and Asia. The earliest illustration found showing the use of ferrets against rabbits occurs in a fourteenth century MS. The animal itself was figured in the sixteenth century by Gesner whose account probably contains most of what was known of the animal at that time.

From the sixteenth century onwards there are increasing numbers of reference to ferrets in both scientific and non-scientific writings, and its taxonomic identification began when Ray (1693) named the animal *'Mustela sylvestris.'* Linnaeus (1758) finally established the identity of the ferret when he named it *Mustela furo.* Since then the question has not been so much one of identity but one of discussion as to whether the ferret is a distinct species or merely a variety of a wild polecat.

ACKNOWLEDGMENT

It is a pleasure to thank G. Habib, B.Sc., for much help with translations and for many discussions; also the staffs of the University and Birmingham Reference Libraries for polite and patient co-operation; and finally Mr. W. J. Pardoe for the execution of Figures 1 and 2.

REFERENCES

ALBERTUS MAGNUS (13th century). *Opera omnia. Animalium,* lib. XXVI. Paris, A. Borgnet, 1891. Vol. XI (pars prior i–xii), lib. XXII, *De animalibus,* Tract XI, p. 409.

ALDROVANDUS, U. *De quadrupedibus viviparis et oviparis.* Bologna, N. Tebaldinus, 1645, *11,* 325.

ARISTOPHANES (425 B.C.). *The Acharnians.* R. T. Elliot, Ed. Oxford, Clarendon Press, 1914, line 879, p. 89.

ARISTOTLE (4th century B.C.). *The history of animals of Aristotle and his treatise on physiognomy,* translated from the Greek by T. Taylor. London, Wilks, 1809, book IX, chap. VI, p. 354.

BUFFON, COUNT DE. *Natural history.* The history of man and quadrupeds. London, Cadell & Davies, 1812, vol. 5, p. 230.

CABRERA, A. La patria di putorius furo. *Bol. Soc. Esp. Hist. nat.,* Dec. 1930, pp. 477–480.

DAREMBERG, CH. and SAGLIO, EDM. *Dictionnaire des antiquités grecques et romaines.* Paris, Hachette et Cie, 1887, vol. 1. 2d pt., p. 1598.

Encyclopaedia Biblica. A dictionary of the Bible. London, Watts & Co., 1901, vol. 2, column 1517.

GESNER, C. *Historiae animalium liber 1 qui est de quadrupedibus viviparis.* Zurich, 1551, lib. I, p. 862.

HARTING, J. E. The early use of ferrets. *The Zoologist,* 1881, 3d ser., *12,* 20–21; The polecat, *Mustela putorius. Ibid.,* 1891, *15,* 281–294; also *The rabbit* (Fur, Feather, and Fin Series). London, Longmans, Green & Co., 1898, p. 90.

HODGKIN, J. 'The Book of St. Albans,' 1486, entitled 'The Compaynys of Beestys and Fowlys.' *Tr. philolog. Soc.*, 1907–1910. Supplement, pp. 1–178.

HOWARD, LORD WILLIAM (17th century). *Selections from the household books of Lord William Howard of Naworth Castle.* London (Surtees Society), 1877, *68*, p. 179.

ISIDORE *of Seville* (6th–7th century). *Patrologie.* Tomus LXXXII Paris, 1850, vol. 4, column 440.

LINNAEUS, C. *A general system of nature.* W. Turton, Tr. London, 1806, vol. 1, p. 60.

MERRET, C. *Pinax rerum naturalium britannicorum.* London, 1667, p. 167.

MILLAIS, J. G. *The mammals of Great Britain and Ireland.* London, Longmans, Green & Co., 1905, vol. 2, p. 136.

MILLER, G. S. *Catalogue of the mammals of Western Europe.* London, Printed by the Order of the Trustees of the British Museum, 1912.

Oxford Junior Encyclopaedia. London, Cumberlege, Oxford University Press, 1950, vol. 9, p. 213.

PLINY *the elder. The natural history,* lib. VIII. J. Bostock and H. T. Riley, Tr. London, Bohn, 1855, vol. 2, p. 349.

POCOCK, R. I. Ferrets and polecats. *Scot. Nat.* 1932, No. 196, pp. 97–108.

RANKING, J. *Wars and sports of the Mongols.* London, 1826, p. 33.

RAY, J. *Synopsis methodica animalium quadrupedum et serpentini generis.* London, Smith & Walford, 1693, p. 198.

ROSS, A. S. C. The Terfinnas and Beormas of Ohthere. Kendal, T. Wilson, 1940, p. 21.

SCHNEIDER. *De arte venandi,* 1788, vol. 1, p. 3. Quoted by Harting, J. E. (1898) *q.v.*

SHAW, T. (1738). *Travels relating to Barbary.* From Pinkerton, J. *A general collection of voyages and travels.* London, Longman, Hurst, Rees, Orme and Brown, 1814, vol. 15, p. 626.

STRABO (1st century B.C.). *The geography.* H. L. Jones, Tr. London, Heinemann, 1923, vol. 2, p. 33.

SWINHOE, R. This reference is contained in a letter dated from the British Consulate, Amoy, June 29, 1861. *Proc. Zool. Soc.*, 1861, p. 390.

THOMAS, O. On the mammals of the Balearic Islands. *Proc. Zool. Soc.*, 1901, Part 1, pp. 35–44.

TRISTRAM, H. B. *The natural history of the Bible.* 2d ed. London, 1868, pp. 85 and 265.

TURNER, G. T. *Select pleas of the forest.* (Selden Society) London, Quaritch, 1901, p. cxxx, footnote no. 1.

TURNER, S. *The history of the Anglo-Saxons.* 4th ed. London, 1823, vol. 3, chap. 6, p. 363.

WHITAKER, T. D. *The history of Manchester in four books.* 2d ed. London, Murray, 1773, vol. 2, book 1, chap. X, p. 103.

WOOD, J. G. *Bible animals.* London, Longmans, Green & Co., 1876, p. 69.

WRIGHT, T. *Anglo-Saxon and Old English vocabularies.* R. P. Wülcker, Ed. 2d ed. London, Trübner & Co., 1884.

St. Bartholomew's Hospital, London, and its Connection with Eminent Book Collectors

JOHN L. THORNTON*

A HOSPITAL having over eight hundred years of history behind it quite obviously abounds in memorable associations with those who have served it during that period. St. Bartholomew's Hospital was founded on its present site in West Smithfield, London in 1123 A.D. and its general history has been narrated at length by Sir Norman Moore,[1] and more briefly by Sir D'Arcy Power.[2] Yet many aspects of its development await investigation, and an interesting volume could profitably be devoted to the personalities who have served the Hospital as physicians, surgeons, governors, stewards, and in other offices less dignified, but of no less importance. Any cursory examination of a list of prominent office holders is rewarding in names eminently distinguished in the history of medicine, and one is particularly impressed with the number of persons, associated in one way or another with St. Bartholomew's Hospital, who have achieved prominence as book collectors, bibliophiles, or founders of libraries.

Medical men have always been noted as collectors of pathological specimens, coins, medals, prints, portraits, and books, and L. W. G. Malcolm[3] has thrown some light on that aspect of their careers. As bibliophiles they have achieved world-wide recognition, and the extent of their collections has been discussed by W. J. Bishop,[4] and by the present writer.[5] Yet it is difficult to trace the remains of certain of these formerly extensive collections, and many have totally disappeared. Also, we must not ignore the medical man who collected more books than required for a personal working library, but not sufficient to achieve fame as a great collector, and this category includes a goodly company. But their existence is difficult to trace where the books, suitably identified, are not housed in the great public collections, or at least have sale catalogues as memorials.

While the fame of the Bodleian Library at Oxford has spread throughout the world, few of us know much about the early history of the collec-

* Librarian, St. Bartholomew's Hospital Medical College, London.

[1] Moore, Sir Norman. *The history of St. Bartholomew's Hospital*. London, 1918. 2 vols.

[2] Power, Sir D'Arcy. *A short history of St. Bartholomew's Hospital (founded 1123); past and present*. London, 1935.

[3] Malcolm, L. W. G. The medical man as a collector in the seventeenth and eighteenth centuries. *Med. Life*, 1935, *42*, 565–620.

[4] Bishop, W. J. Some medical bibliophiles and their libraries. *J. Hist. Med.*, 1948, *3*, 229–262.

[5] Thornton, J. L. *Medical books, libraries and collectors [etc.]*. London, 1949, pp. 171–190.

tion or of its founder. It is of interest to recall the connection between Sir Thomas Bodley and St. Bartholomew's Hospital, as he lived for some years within its walls, and many of the books were housed there before being sent down to Oxford. It was in 1599/1600 that Bodley came to live within the Hospital, paying an annual rent of £5. 6s. 8d. for property then known as "The Great House." Sir D'Arcy Power[6] reproduced a plan of these premises made between 1604 and 1613, indicating their position and showing a three-storey building with a courtyard in front and a small garden on the east side. A gallery, often referred to in Bodley's letters to Thomas James, his librarian, ran at right angles to the southern end of the house, was lighted by five large windows, and had chimneys. The books were stored in this gallery, and on November 14, 1604 Bodley wrote to James that he possessed "about 2,000 [books] already gathered in my Gallerie." Lady Bodley died in this house in 1610/11, a memorial tablet to her in the Parish Church of St. Bartholomew-the-Less, which is inside the Hospital grounds, reading: "THOMAS BODLEIUS/EQUES AURATUS/FECIT ANNAE CONJUGI/PIISSIMAE, ATQUE/OMNIBUS EXEMPLIS/BENE DE SE MERITAE/CUM QUA DULCITER/VIXIT ANN XXIIII." Sir Thomas Bodley also died in "The Great House," on January 28, 1612/13, but was buried in Merton College Chapel, Oxford. He was attended by William Harvey, Physician to the Hospital, who must have appreciated the efforts of a kindred spirit in founding a library for scholars.

The fame of William Harvey (1578–1657) rests almost entirely upon his experiments on the circulation of the blood, and upon his two major publications, *De motu cordis* (1628) and *De generatione animalium* (1651). Yet he was also an eminent physician and research worker. Appointed Physician to St. Bartholomew's Hospital in 1609, he keenly pursued the duties of his office, but as Physician-in-Ordinary to King Charles I he was frequently absent. In 1632 Harvey drew up rules for the library of the College of Physicians, and had contributed £100 towards the cost of the site. Harvey was also a benefactor of the College by his Will, which reads: "Touching my books and household stuff, pictures and apparrell of which I have not already disposed I give to the College of Physicians all my books and papers and my best Persia long carpet, and my blue satin embroidered cushion, one pair of brass Andirons with fire shovel and tongs of brass for the ornament of the meeting room I have erected for that purpose. Item, I give my velvet gown to my loving friend Mr. Doctor Scarborough desir-

[6] Power, Sir D'Arcy. Sir Thomas Bodley's London house. *Bodleian Quart. Rec.*, 1936, *8*, 203–205.

ing him and my loving friend Mr. Doctor Ent to look over those scattered remnant of my poor Library and what books, papers or rare collections they may think fit to present to the College and the rest to be sold and with the money buy better."[7] Harvey's mention of the "scattered remnant" of his library refers to the incident in 1642, during the Civil War, when a mob raided his lodgings in London, destroying his invaluable manuscripts on the development of insects and on comparative anatomy, together with many of his books. The material that did reach the College of Physicians was destroyed during the Great Fire of 1666. William Harvey drew up a set of rules for the governance of St. Bartholomew's Hospital,[8] and these ordinances were still in use many years after his death. But he lived in unsettled times, and might have achieved even more honour had he been permitted to concentrate on his duties as Physician to the Hospital, or upon research work in the fields of embryology and comparative anatomy.

Although Francis Bernard (1627–1698) did not join the staff of St. Bartholomew's Hospital until after the death of William Harvey, there was some relationship between the two men, for we find that Bernard possessed a copy of Harvey's *Exercitationes de generatione* which had been presented to him by the author.[9] Perhaps his passion for book collecting had shown itself as early as 1651, and was encouraged by the kindred interest of Harvey. Francis Bernard was elected Apothecary to the Hospital on May 22, 1661 from a total of twenty-six applicants, Bernard having a letter of support from the King. During the Plague, Bernard remained at his post treating the sick, the two physicians, Dr. (afterwards Sir) John Micklethwaite and Dr. Christopher Terne absenting themselves. On December 23, 1665 Bernard was awarded £25 by the Governors of the Hospital for remaining to minister to the sick during that period,[10] and doubtless his zeal influenced his later appointment as assistant physician. This took place on November 20, 1678, and it was most unusual for an apothecary to attain that position. Also in 1678, Francis Bernard was created M.D. by Archbishop Sancroft, received the same degree from Cambridge University, and became Physician-in-Ordinary to James II. He was appointed Physician to St. Bartholomew's Hospital on October 22, 1683.

Francis Bernard resided in Little Britain, just beside St. Bartholomew's Hospital, and there amassed an extensive collection of books. Moreover, he is reputed to have read every volume in his library! He knew Greek, Latin,

[7] Power, Sir D'Arcy. *William Harvey*. London, 1897, p. 182.

[8] Power, Sir D'Arcy. *Ibid.*, pp. 99–103.

[9] Moore, Sir Norman. *Op. cit.*, vol. 2, p. 513.

[10] Whitteridge, Gweneth. St. Bartholomew's Hospital and the plague of 1665. Part 2. *St. Bart. Hosp. J.*, 1948, *52*, 32.

Italian, Spanish, and French, and was interested in a wide range of subjects. He was a great friend of Sir Hans Sloane, and one of his case-books is preserved among the Sloane MSS. in the British Museum. Bernard died in 1698 and was buried in St. Botolph's, Aldersgate, where his wife erected a monument to his memory, but this memorial is no longer extant. His books were sold by auction, forming the most extensive library sale of the seventeenth century. A list of the books was printed as *A catalogue of the Library of the late learned Dr. Francis Bernard, Fellow of the College of Physicians, and Physician to S. Bartholomew's Hospital . . . Which will be sold by auction at the doctor's late dwelling house in Little Britain: the sale to begin on Tuesday, Octb.4,1698.* This contains 14,747 works and 39 bundles, there being 869 books on Theology, 277 on Law, 938 on Mathematics, 4,484 on Medicine, 4,950 on Philology, *etc.*, 1,163 in Italian, Spanish, and French, and 2,066 devoted to Divinity, History, *etc.* The preface to the catalogue reads:

> We must confess that being a Person who Collected his Books for Use, and not for Ostentation or Ornament, he seem'd no more solicitous about their Dress than his own; and therefore you'll find that a gilt Back or a large Margin was very seldom any inducement to him to buy. . . . As for the Books of his own Faculty, tho' it be not an entire Collection (for who could, or rather, who would have one in Physick?) yet it may be said, that it is infinitely the best and largest that ever yet appeared in these Islands. . . . Certain it is, this Library contains not a few which never appeared in any Auction here before; nor indeed, as I have heard him say, for ought he knew, and he knew as well as any man living, in any Printed Catalogue in the World.

Misprints abound in the catalogue, which includes several Caxtons, the number and prices of which vary with the authorities mentioning them. De Ricci[11] gives 16 Caxtons, which sold for four or five shillings each; Lawler[12] lists 22 Caxtons with prices obtained, which total £4. 13s. 4d.; Elton[13] mentions "thirteen fine Caxtons, which fetched altogether less than two guineas at his sale"; and Fletcher[14] states that there were "about a dozen" Caxtons, which "sold for a little over two guineas." A priced catalogue in the British Museum would settle the matter, as it would that of the total sum raised, which has been given as about £5,000 (Lawler) and £1,920 (Fletcher), but the total of 15,000 lots renders it a task for an extreme enthusiast.[15]

[11] De Ricci, Seymour. *English collectors of books & manuscripts (1530–1930), and their marks of ownership* [*etc.*]. Cambridge, 1930, p. 32.

[12] Lawler, John. *Book auctions in England in the seventeenth century (1676–1700)* [*etc.*] London (Book-Lover's Library), 1898, pp. 195–196.

[13] Elton, Charles Isaac, and Elton, Mary Augusta. *The great book collectors.* London (Books about Books), 1893, p. 138.

[14] Fletcher, Walter Younger. *English book collectors.* London (English Bookman's Library), 1902, pp. 112–113.

[15] See also Thornton, J. L. In our Library. IV.

Dr. Edward Browne (1642–1708) was contemporary with Francis Bernard on the staff of the Hospital, having been appointed Physician on September 16, 1682, supported by a letter of recommendation from the King. He held office until his death on August 28, 1708. Edward Browne was the eldest son of Sir Thomas Browne (1605–1682), distinguished author of *Religio medici*. Edward attended the lectures at Barber Surgeon's Hall of Dr. Christopher Terne,[16] also Physician to Bart's Hospital, and in 1672 married the daughter of his teacher. Browne was elected Fellow of the Royal Society in 1667, and Fellow of the College of Physicians in 1675. He travelled extensively on the Continent, the letters between himself and his father written during that tour making fascinating reading, and upon his return Edward Browne published *A brief account of some travels in Hungaria, Styria, Bulgaria, Thessaly, Austria, Servia, Carynthia, Carniola and Friuli*, London, 1672. A second volume appeared in 1677, and both parts were published together in 1687.

When Physician to the Hospital, Edward Browne lived in Salisbury Court, Fleet Street, and built up an extensive, successful practice. He inherited his father's library on the latter's death, and in 1710 a sale catalogue of the joint libraries was printed as, *A catalogue of the libraries of the learned Sir Thomas Brown, and Dr. Edward Brown, his son, late President of the College of Physicians. . . . Which will begin to be sold by auction, at the Black-boy Coffee house in Ave-Mary Lane . . . the 8th day of January 1710/11 . . . By Thomas Ballard, bookseller*, [*etc.*], (London, 1710).[17] Copies of this catalogue are extremely rare, there being only four known, one being in the British Museum, another at Worcester College, Oxford, a third at McGill University,[18] and a fourth in the possession of Professor John F. Fulton of Yale. The catalogue includes 2,377 lots, classified by subject and subdivided by size, and it is probable that most of the items originally belonged to Sir Thomas Browne. Edward Browne prepared a copy of the first Pharmacopoeia of St. Bartholomew's Hospital, and his MS. of this is housed in the British Museum.[19] When he died on August 28, 1708 he was President of the College of Physicians, having attained the highest distinction the profession could offer.

Charles Bernard (1650–1711), a much younger brother of Francis

Catalogue of Dr. Francis Bernard's library, 1698. *St. Bart. Hosp. J.*, 1946–7, *50*, 100.

[16] Edward Browne's MS. notes of these lectures are preserved in the British Museum.

[17] Facsimile of the title-page of this catalogue is reproduced in Geoffrey L. Keynes' *A bibliography of Sir Thomas Browne, Kt, M.D.* Cambridge, 1924, p. 184; also in, Thornton, J. L. *Medical books, libraries and collectors* [*etc.*] London, 1949, p. 177.

[18] *Bibliotheca Osleriana*, 4532.

[19] Reproduced in Church, Sir William S. Our Hospital Pharmacopoeia and Apothecary's Shop. *St. Bart. Hosp. Rep.*, 1884, *20*, 298–304.

Bernard, mentioned above, was elected Assistant Surgeon to St. Bartholomew's Hospital on November 13, 1683, and full Surgeon on August 26, 1686. He held this office until his death and was also Serjeant Surgeon to Queen Anne from 1702. Sir Norman Moore states that Charles Bernard was the first surgeon in England to have a good library and to have read it. Unlike his brother, from whom he probably acquired the taste for literature and learning, Charles also collected as a bibliophile and favoured well-printed texts in sumptuous bindings.

Charles Bernard was apprenticed on August 16, 1670 to Henry Boone, of the United Company of Barber Surgeons, and was admitted to the Freedom of the Company on December 4, 1677. He has been mentioned as the first Englishman to note that after an operation for cancer, the growth often reappeared.[20] The sale catalogue of his library was published as *Bibliotheca Bernardiana: or a catalogue of the library of the late Charles Bernard, Esq., Serjeant Surgeon to Her Majesty. . . . With several MSS. ancient and modern which will begin to be sold by auction on Thursday, the 22nd of March, 1710/ 1. At the Black-Boy Coffee-House in Ave-Mary-Lane, near Ludgate Street,* [*etc.*].[21] The books are grouped under theology, medicine, history, classical, miscellaneous, mathematics, French, Italian, English, prints, and MSS., each subject being subdivided by size. There are 1,234 numbered octavo items, 953 quartos, and 686 folios, and the sale was lengthy and well attended. Swift records visits to view the books in his *Journal to Stella* under the date of March 11, 1710/11: "I went to see poor Charles Bernard's books, which are to be sold by auction, and I itch to lay out nine or ten pounds for some fine editions of fine authors. But it is too far, and I shall let it slip, as I usually do all such opportunities." And again under March 29: "I . . . went to see the auction of poor Charles Bernard's books: they were in the middle of the physic books; so I bought none; and they are so dear. I believe I shall buy none, and there's an end."

In addition to having had Sir Thomas Bodley living within its walls, St. Bartholomew's Hospital has yet another connection with the City of Oxford. John Radcliffe (1650–1714), who was responsible for the building and endowment of the Radcliffe Library at Oxford, was elected a Governor on September 13, 1690, when "a green staff was sent to him," according to custom. He had been educated at University College, Oxford, and practised there before coming to London in 1684 when he settled in Bow Street. There he built up a handsome practice and attended William III. He was Member of Parliament for Bramber from 1690 to 1695, and in 1713 sat in

[20] Moore, Sir Norman. *Op. cit.*, vol. 2, p. 629.

[21] A copy in the Library of the Royal College of Surgeons of England is priced throughout.

the House for Buckingham. On his retirement he recommended to his patients the then rising young Dr. Richard Mead. By his will he left most of his property to Oxford University, endowed two medical travelling fellowships at University College, and provided funds for the enlargement of the College buildings and for a library. Radcliffe Infirmary and Observatory were built, the Radcliffe Library being completed in 1747. His Will reads: "I give unto St. Bartholomew's Hospital in Smithfield, London, for ever, the yearly sum of five hundred Pounds, towards mending their Diet; and the farther yearly Sum of one hundred Pounds for ever, for buying of Linnen."[22] This money is still paid annually to the Hospital. The Hospital also further benefited at later dates at the hands of the Radcliffe Trustees who in 1756 granted the sum of £2,250 towards rebuilding, and in 1822 the sum of £500 towards enlarging the theatre built to house those attending John Abernethy's lectures. John Radcliffe was no scholar but an eminent patron of learning, and he is said to have stated that his personal medical library consisted of "some phials, a skeleton, and a herbal."

Radcliffe was very friendly with Richard Mead (1673–1754), who took over his house in Bloomsbury Square on his death. Both served as Governors of St. Bartholomew's Hospital, Mead having been elected to that office on March 11, 1720. The latter spent some time on the Continent after the age of sixteen, working at Utrecht, Leyden (where he studied medicine under Archibald Pitcairn), and at Padua, where he took a medical degree. Mead then returned to Stepney, setting up in practice in 1696. In 1702 he published *A mechanical account of poisons,* an abstract of which appeared in the *Philosophical Transactions,* and the year 1703 saw his election as a Fellow of the Royal Society. Also in that year Mead became Physician to St. Thomas's Hospital and was elected a Governor on his resignation twelve years later. He acquired an M.D. from Oxford University in 1707, was elected a Fellow of the College of Physicians in 1716, serving the College three times as Censor, and became personal physician to George II in 1727. Mead was also the author of *De imperio solis ac lunae in corpora humana, et morbis inde oriundis,* 1704; *A short discourse concerning pestilential contagion and the methods to be used to prevent it,* 1720, of which seven editions appeared in one year, two later editions also appearing; *De variolis et morbillis liber,* [*etc.*], 1747; and *Monita et praecepta medica,* 1751. Mead edited William Cowper's *Myotomia reformata,* 1724, and financed the publication of several other important works, including De Thou's *Historia sui temporis,* 7 vols., 1733.

[22] [Pittis, W.] *Dr. Radcliffe's life and letters,* 4th ed., London, 1736, p. 78.

Richard Mead was a great reader and collected together large numbers of printed books, statues, coins, gems, drawings and manuscripts, many of which were acquired in Rome. When he removed his home to Great Ormand Street he built a gallery to house the collection and employed scholars and artists to further scholarship. After his death the entire collection was sold, the Greek manuscripts being purchased by Anthony Askew. A catalogue was published with the title *Bibliotheca Meadiana; sive catalogus librorum Richardi Mead, M.D. qui prostabunt venales sub hasta, apud Samuelem Baker; in vico dicto York Street, Covent Garden, Londini, die lunae 18vo Novembris, Iterumque die lunae 7mo April, 1755,* the sale occupying twenty-eight days. The 10,000 printed books realised £5,518. 18s. 11d., and the total sales amounted to £16,047. 12s. 0d. Thus terminated the collection amassed during the lifetime of a man of whom Dr. Johnson once said, "Dr. Mead lived more in the broad sunshine of life than almost any man."

On June 21, 1733 Richard Mead had been appointed to serve on the Apothecary's Shop Committee at St. Bartholomew's Hospital in company with Sir Hans Sloane (1660–1752). The latter was also a great friend of Francis Bernard and had been elected a Governor of the Hospital on August 1, 1729. Sir Hans Sloane came to London from County Down at eighteen years of age and went to Paris, where he studied botany under Tournefort at the Jardin des Plantes. He then proceeded to Montpellier, where he studied natural science and took a medical degree at the University of Orange before returning to London in 1684. He then went to live with Thomas Sydenham (1624–1689) and assisted him in his practice. Sloane had become friendly with Robert Boyle and with John Ray. He was elected a Fellow of the Royal Society in 1684, and three years later, a Fellow of the College of Physicians. In 1687 he went to Jamaica as physician to the Duke of Albemarle, spending some fifteen months studying the natural history of the Island. Upon the death of the Duke, Sloane returned to England, bringing over eight hundred specimens of plants in addition to animals, fish, birds, shells, etc. In 1693 he became Secretary of the Royal Society and revived publication of the *Philosophical Transactions,* which he edited until 1712.

Sloane was aided by John Ray in preparing his *Catalogus plantarum quae in insula Jamaica sponte proveniunt,* 1696, and in 1707 there appeared the first volume of his book, *A voyage to the islands of Madeira, Barbados, Nieves, St. Christopher and Jamaica, with the natural history of the last of those islands,* the second volume being published in 1725. He was created

a baronet in 1716, served as President of the College of Physicians from 1719 to 1735, and in 1729 succeeded Newton as President of the Royal Society, occupying that distinguished position until 1741. His appointment in 1740 as physician to George II crowned his career and in that year he retired from practice, taking a house at Chelsea. There he arranged his enormous collection of antiquities, coins, medals, seals, gems, natural history specimens, prints, drawings, manuscripts, and books. He possessed over 3,550 MSS. and 50,000 books at the time of his death, and these together with the rest of his collection were offered to the Nation in return for £20,000, a very small proportion of their value. This material was purchased in 1754 with money raised by means of a lottery and, together with the Harleian MSS. and the Cottonian Collection, was placed in Montague House, Bloomsbury, to found the British Museum. This was first opened to the public in 1757.

When Richard Mead died, he was succeeded in the book world by Anthony Askew (1722–1772) who acquired Mead's Greek manuscripts and many other items from his library. After qualifying M.B. at Cambridge in 1745, Askew spent two years travelling in Italy, Hungary, Athens, and Constantinople, and during that period commenced collecting the nucleus of his library. He received his M.D. degree from Cambridge in 1750 and soon afterwards settled in London. He was elected a Fellow of the Royal Society in 1749, of the College of Physicians in 1753, and held several official positions in the College. On August 22, 1754 he was elected Physician to St. Bartholomew's Hospital and held that appointment until his death. He was also Physician to Christ's Hospital. Askew lived in Queen's Square, Bloomsbury, and was better known as a classical scholar than as a physician. He was a warm friend of Mead to whom he dedicated his only printed work, a specimen of an intended new edition of Aeschylus entitled *Novae editionis tragaediarum Aeschyli specimen,* 1746.

Askew is credited with having made bibliomania fashionable. He possessed numerous rare manuscripts and sumptuously bound books in his collection and many association items, such as a 1632 Shakespeare containing writing of Charles I, which had belonged to General Monk. He owned the first printed editions of most of the classics but, strangely enough, possessed not more than one hundred and fifty medical items. After the death of Askew his library was sold at an auction that lasted from February 13 to March 7, 1775.[23] The catalogue was printed as *Bibliotheca Askeviana,*

[23] See Barnes, Henry. On Anthony Askew, M.D., F.R.S. and his library. *Proc. Roy. Soc. Med., Sect. Hist. Med.,* 1916, *9,* 23–27.

sive catalogus librorum rarissimorum Antonii Askew, M.D. Quorum auctio sint apud S. Baker & G. Leigh, in vico dico York Street, Covent Garden, Londini, die lunae 13 Februarii MDCCLXXV. in undeviginti sequentes dies. Entries were arranged in four alphabetical sequences, English, French, Italian and Spanish, and Greek and Latin. There were 3,570 numbered lots containing "the *best, rarest and most* valuable collection of Greek *and* Latin Books that were ever sold in England." The French bookseller De Bure, George III, Dr. William Hunter, the British Museum, the Bodleian Library, and Cambridge University made extensive purchases. A priced sale catalogue in the University of London Library indicates the sum of money paid for various items, the total sum amounting to £3,993. os. 6d. Askew was renowned for his hospitality and consorted with scholars from all over the world. He succeeded to the gold-headed cane which had previously been carried by John Radcliffe and Richard Mead and was to pass to William Pitcairn and Matthew Baillie before being presented to the College of Physicians by the widow of the last named.[24]

St. Bartholomew's Hospital has had intimate connection with book collectors up to the present day, and although we cannot deal in any detail with contemporary collections, such as that magnificent, well-selected, and beautifully preserved library belonging to Mr. Geoffrey Keynes, Consulting Surgeon to the Hospital, we must mention that formerly owned by Sir D'Arcy Power (1855–1941). This library was auctioned shortly after his death, a catalogue having been prepared by Messrs. Sotheby & Co. as *Catalogue of valuable books, manuscripts, autograph letters, etc., comprising the property of Sir D'Arcy Power,* [*etc.*], 1941. This reveals numerous early texts on medicine and surgery, together with valuable bibliographical tomes, but many of the items were eventually sold in a street market. Sir D'Arcy was a staunch Bart's man, intimately connected with the Hospital from the time of his entry as a student in 1878 until his death. A successful surgeon, he will be more prominently remembered as a historian of medicine, his writings on that subject being both scholarly and absorbing.

It is interesting to record the association of these figures with one institution and to note their relationship with each other. Probably bibliomania *is* infectious, for did not Sir William Osler transmit it to several of his contemporaries, including Harvey Cushing who was, incidently, a Bart's man by adoption, having been elected a Perpetual Student in 1922.

[24] See [MacMichael, William.] *The gold-headed cane.* William Munk, Ed. London, 1884.

James Esdaile, Hypnotic Dreams, and Hypnoanalysis*

JEROME M. SCHNECK†

ALTHOUGH an important figure in the history of hypnosis, James Esdaile (1808–1859) has been accorded relatively little attention in several recent volumes on this subject. The most informative data may be found in the classic volume by Bramwell[1] published several years ago and in a recent paper by Rosen.[2] Despite his status in historical perspective, he is probably discussed little because his contributions were almost completely in the area of medical and surgical mesmerism. Thus, his work is meaningful in relation to the history of anesthesia. With certain exceptions hypnotic anesthesia is seldom used now, although it would appear to have possible applications which have never been tested adequately within the framework of modern medicine.[3]

Esdaile worked with mesmerism in medicine and surgery mostly during the 1840's. The story need not be repeated here. Much of his achievement occurred in India, and a reading of his original accounts is quite impressive. In 1846 he published a book, *Mesmerism in India,*[4] based on his early medical and surgical applications of mesmerism. It is probably one of the most fascinating books in the history of hypnosis. The fact that a number of the concepts are outdated now is to be expected. Some very brief comments within a small section of this book pertain to mesmeric dream material.[5] This and related data which may easily remain unnoticed by the reader impressed this writer in view of his own current studies in clinical and experimental hypnosis, especially the area of hypnoanalysis. Also, the data can be related to observations by others in recent years.

Under a section called "Dreaming of the Organs of Sentiment and Intellect," Esdaile wrote:

* Read before The Society for Clinical and Experimental Hypnosis, January 1950.

† New York, N. Y.

[1] Bramwell, J. M. *Hypnotism, its history, practice and theory*. London, William Rider and Son, Ltd., 1921.

[2] Rosen, G. Mesmerism and surgery, a strange chapter in the history of anesthesia. *J. Hist. Med.*, 1946, *1*, 527–550.

[3] One example of such application, which also has historical antecedents, is: Kroger, W. S. and De Lee, S. T. The use of the hypnoidal state as an amnesic, analgesic and anesthetic agent in obstetrics. *Amer. J. Obstet. Gynec.*, 1943, *46*, 655–661.

[4] The edition referred to throughout is Esdaile, J. *Mesmerism in India and its practical application in surgery and medicine*. Chicago, Psychic Research Company, 1902. Punctuation as used here is retained in the quotations.

[5] *Ibid.*, pp. 72–75.

. . . If the reflecting organs are chiefly called into play, then the man of business does a stroke in trade, or conceives a capital speculation that might be of use to him, if he could recollect it when awake: the student easily conquers his difficulties; the mathematician solves the problem, and the historian removes a doubt; the poet's thoughts and lines no longer leave his brain like bird-lime, but he pours forth his soul "in thoughts that breathe, and words that burn." All good dreamers, in fact, confess that they think, say, and do better things when asleep than when awake. Or, let us suppose that the reflecting organs have been intensely engaged during the day, in considering our proper course of action in certain circumstances, and the probable consequences, or that a craving to penetrate the future has been the haunting idea; then the judgment is undisturbed by external impressions, and undistracted by passion, self-interest, and routine habits of thought, and supplied by memory only with the past experience and knowledge that bear upon the question; under these circumstances it is imaginable that the mind may jump to just conclusions, and receive a clear and happy glimpse into futurity. These impressions, when remembered on waking, and verified by subsequent events, are naturally converted into inspired dreams, and supernatural warnings, merely by the train of reasoning having been lost. The persons, in reality, have reasoned correctly, but by an unusual mode, whose processes have penetrated the future, only by comparing it with the past. In this way

"Old experience may attain
To something like prophetic strain."

and such dreams being remembered, and the reasoning analysed, may be of real use to us, in shaping the course of our present and future conduct, because our sleeping conclusions have been come to from just premises, and the natural process of connecting cause and effect: whether this is done in sleeping or waking, is of little consequence, the results being equally correct.

The next paragraph deals with arriving at conclusions during dreaming, regarding the nature of a disease process and prescribing for its cure.

Disregarding at this time the question of self-diagnosis and prescription for cure during dreaming in relation to somatic disability, and avoiding in this discussion any consideration of implications of clairvoyance in the quoted passage, it appears that Esdaile viewed with interest those aspects of dreaming involving planning, problem solving, sudden insight, and creative experience. The comments that follow then are of special interest. Under the section called "Mesmeric Dreaming of Different Organs," he wrote:

As in natural sleep the organs are often preternaturally excited, and their powers singularly increased, by the concentration of the nervous energy upon them; so, in the mesmeric sleep, this may be effected, and of course to a greater and more wonderful extent, by the person being under the control of a reflecting and directing agent, instead of being left to the fitful lights of his own imagination, and the short unsustained flights of his intellect, as in common dreaming. This power of acting on separate portions of the brain, and thereby inducing such trains of thought as we may be pleased to excite, will perhaps be found of practical utility in the treatment of mental diseases; the diseased haunting idea might be banished, and a more healthy tone of feeling and reasoning substituted and sustained, till a new and better habit of mind was produced. I see

no reason to doubt that the mental organs can be isolated and exalted by the mesmeric influence under the direction of a skilful leader and suggester, and can readily believe that the mind, by this artificial stimulus, may be excited into more vigorous activity than when acted upon by the usual conditions of life. If persons may derive benefit from night thoughts in dreams, their sleep-waking day thoughts should be more valuable; but the one has no more pretensions to supernatural power than the other. The night-dream is woven out of past impressions lighted up by a flickering imagination and a wavering judgment; and the somnambulist has only the advantage of having his thoughts sustained and concentrated by his mental director.[6]

These observations of more than one hundred years ago have an unquestionable relationship to the study and use of hypnotic dreams in hypnotherapy today. In view of the nature of modern hypnotic practice they possess an even more intimate association with it than does the remainder of the volume. Interestingly, however, they appear to have passed virtually unnoticed. In hypnoanalytic practice there would in general be greater reliance on the patient's participation in this work with dreams than is seemingly implied in some of Esdaile's comments, but his observations must be regarded in the light of hypnotic practice and theory during the middle of the last century. In any event, he is surely to be credited with awareness of the potentialities of hypnotic subjects.

The variety of uses to which dreams may be put in hypnotherapy and hypnoanalysis has been described in varying detail in some recent books on hypnosis[7] and in several articles by this writer.[8] Some of them may be outlined briefly. During hypnosis a patient may be instructed to dream about something which will reveal a problem he unknowingly wishes to clarify. He may be told to dream in order to arrive at an answer to the method of resolving some conflict. Dreams may be used to help clarify some difficulties in interpersonal relationships. They may be used to elucidate feelings toward the therapist. They may be employed as a method of redreaming a previously forgotten nocturnal dream. Hypnotic dreams may be suggested

[6] A state of somnambulism, as the word is generally used today in connection with hypnotic phenomena, implying the development of complete posthypnotic amnesia with possibly some hypnotic phenomena even more difficult to attain, has been found by this writer to be unnecessary for hypnoanalytic work. If a somnambulistic trance state can be achieved with the patient capable of demonstrating other essential hypnotic activity, certain advantages do obtain. But a deep trance is not essential for hypnoanalysis and hypnotic dreams may be induced without it.

[7] Brenman, M. and Gill, M. M. *Hypnotherapy.* New York, Josiah Macy, Jr. Foundation, 1944; LeCron, L. M. and Bordeaux, J. *Hypnotism today.* New York, Grune and Stratton, 1947; Watkins, J. G. *Hypnotherapy of war neuroses.* New York, Ronald Press Company, 1949; Wolberg, L. R. *Hypnoanalysis.* New York, Grune and Stratton, 1945, and *Medical hypnosis.* New York, Grune and Stratton, 1948.

[8] Schneck, J. M. The role of a dream in treatment with hypnosis. *Psychoanal. Rev.*, 1947, *34*, 485–491; Hypnotherapy of a patient with an animal phobia. *J. nerv. men. Dis.* (In press); The elucidation of spontaneous sensory and motor phenomena during hypnoanalysis. *Psychoanal. Rev.* (In press); The hypnoanalysis of phobic reactions, to be published in a volume of hypnosis edited by L. M. LeCron; also, unpublished data.

in order to complete previous nocturnal dreams. They may be utilized to help interpret conflicts or feelings and also in the interpretation of other dreams. Dreams in hypnosis may be employed to revive forgotten memories. They may be used to initiate dreamwork which will then be continued later as nocturnal dreams. They may be used to help plan future action. Posthypnotic nocturnal dreams for the above purposes may be suggested during hypnosis too. These are just a few of the purposes to which hypnotic dreams may be put. Current references offer an extension of these ideas. The extent of involvement of patients in the interpretations would depend on their personalities and aptitudes. The approach of the therapists in interpretation would depend upon their theoretical orientations. Extensions of the usual use of visual imagery during hypnosis which is allied to hypnotic dream utilization have been attempted by the writer and appear in some of his publications.[9] A major feature entails visualization of certain types of scenes during hypnosis.[10] This is combined with actual manual automatic writing and such writing as an aspect of visual imagery also.[11] Experimental work with hypnotic dreams from psychoanalytic and non-analytic orientations have appeared.[12]

The reason as to why Esdaile did not present more extensive material within this area may perhaps be answered in part by his own comment following the quotations given above:

> My psychological experiments have been very limited, partly because I feared to bewilder myself at the outset, and also from want of proper subjects to try them on. The mental range of my patients is so circumscribed, that the topics of food, drink and clothing, almost exhaust it, and with most of them I have no common language. But I have done enough to show me how the higher grades of somnambulism may be reached; and with more highly organised and intellectual natures, I should have good hopes of doing so.

It is not unlikely that investigators other than Esdaile made similar observations before, at the same time, and somewhat after his investigations took place. Perhaps an important reason for his failure to capitalize on some of his observations was his own lack of knowledge about any system of

[9] *Ibid.*; also, Hypnoanalysis, hypnotherapy, and card 12M of the thematic apperception test. *J. gen. Psychol.* (In press).

[10] This technique is under investigation by the writer in relation to certain psychological tests. A current project is based on a preliminary paper: Kline, M. V. and Schneck, J. M. Hypnosis in relation to the word association test. *J. gen. Psychol.* (In press).

[11] Visual imagery must be viewed too in relation to certain aspects of hypnotic regression: Schneck, J. M. Psychogenic cardiovascular reaction interpreted and successfully treated with hypnosis. *Psychoanal. Rev.*, 1948, *35* (No. 1, January 1948).

[12] Farber, L. H. and Fisher, C. An experimental approach to dream psychology through the use of hypnosis. *Psychoanal. Quart.*, 1943, *12*, no. 2, pp. 202–216; Klein, D. B. The experimental production of dreams during hypnosis. *Univ. Texas Bull.*, March 1, 1930, No. 3009, pp. 1–71.

psychology which would have lent meaning to his findings. Today the situation is somewhat different. Certainly from the vantage point of hypnoanalysis[13] and the use of dream data, Freudian psychology and psychopathology are such a system. It is only too well known that Freud himself found it necessary to relinquish his work with hypnosis in order to develop further his own investigations. Now it is possible to further certain aspects of hypnotherapeutic endeavor with data he made available. In any case, Freudian theory and some of its derivatives have furthered possibilities in hypnotherapeutic investigation. What the future holds in store remains to be seen. It would appear nevertheless that the observations and comments of Esdaile have a place in the history of the psychologic areas of hypnotic practice and research.

[13] The word, hypnoanalysis, is used usually to denote therapy employing hypnosis within the framework of psychoanalytic theory and technique. In a very strict sense it would involve also the analysis of transference relationships between patient and therapist.

The History of Research on the Adrenals 1563–1900

A. LENARD*

THE adrenals belong to the organs which managed to hide for a long time from the anatomist's searching eyes, and their function has remained a secret even longer. The physician of Cardinal Della Rovere, Bartholomeus Eustachius, was the first to take note of their existence. The discovery—one of the few made in Rome, the city which never showed much interest in earthly knowledge—was published at Venice in 1563. Chapter VI, "De glandulis quae renibus incumbunt" of the first section of his *Opuscula anatomica*[1] (De renum structura) contains the description, which still holds true:

> Even if many will consider sufficient what we have said about the surface of the kidneys, somebody could well object that I have neglected something and I consider it indicated to say something of the glands, diligently overlooked [diligenter praetermissis] by other anatomists. Both kidneys are capped on the extremity towards the cava by a gland. Both are connected with a fold of the peritoneum in such a way that one, if he is not very attentive, does really overlook them, as if they were not present. Their shape resembles that of the kidneys . . . sometimes one is bigger, sometimes another . . . early anatomists and those who write ample treatises on this art in our days failed to detect them. They, pretending to be exact, stand so obstinately for their own and their masters' errors that often they seem to be fighters rather than searchers of anatomical truth.

Eustachius does not spare his fellow anatomists; all his life he fought bitterly as one of the last and not always successful defenders of Galen. He intended to entitle his last and most conclusive work, which would contain his findings in comparative anatomy, *De dissensionibus ac controversiis anatomicis.*

In the time of "anatomici contentiosi"—the "fighting anatomists"—such a discovery could not remain without contradiction. Nobody is a prophet in his country, and the Roman anatomist, Archangelo Piccolomini,[2] who enriched anatomy only by giving a name to the "linea candida abdominis," soon attacked Eustachius. His *Anatomicae prelectiones* printed in 1586 form a heavy volume, full of odd ideas and theories, and while this work of Eustachius remained almost unobserved, so that many

* Rome, Italy.

[1] Eustachius, B. Opuscula anatomica de renum structura, officio et administratione . . . Venice, V. Lucchino, 1563.

[2] Piccolomini, A. Anatomicae prelectiones explicantes mirificam corporis humani fabricam. Rome, B. Bonfadinus, 1586.

facts contained therein had to be rediscovered later on, his adversary managed to create confusion for a hundred years. Reading a few pages of the "lectures," we learn that testicles collect the sperm from all parts of the body and that the kidneys do the same for water. "Sometimes one may see two or more glands lying on the kidneys [he writes] but we do not think they deserve special attention, because they are not to be found in every case and they have no flesh or parenchyma of their own . . . so that they might be considered renal excrescences. They form part of the renal parenchyma. Why do they exist in a few? The same way supra-abundance of material creates a sixth finger, they originate from a seminal surplus [*ex copiore seminis*] and that is the way they come out of the kidneys."

Another famous physician who remained skeptical was André Du Laurens, physician of Henry IV of France. His great handbook of anatomy,[3] which testifies with a host of classic quotations that the author did not lack learning, is, for us, a collection of strange theories. As to suprarenal glands, he remarked briefly: "Eustachius claims to find a gland above the kidneys. Sometimes we saw that too; often, however, we stated that there was no such gland."

A short time before (1598) Jean Riolan, the elder, the great French physician and arch-enemy of Paracelsus, who had summed up the medical knowledge of his times in a unique heavy volume,[4] had described the suprarenal gland. It would be difficult to decide whether he had read the booklet of Eustachius; it is certainly not likely. He seems to be the first one who thought about the function of the gland, and his theory, no worse than many which came later on, has the advantage of great simplicity. He says: ". . . upon this membrane there are glands on the outside, which look towards the cava and are embedded in fat. I think they lie there to support the nerves, which come from the ribs and go to the mesentery."

(Reading the discussions of the old masters of anatomy who could not agree about absence or presence of organs, we have to consider it an advantage that, in consequence of all the difficulties encountered in procuring bodies, they had to get their material from the gallows. Thus pathological changes were not numerous and they largely avoided confusing tumors with organs.)

It is to the credit of the Padua school that it definitely recognized the existence of the adrenals. The great teachers of the "Gymnasium Patavinum" were for more than a hundred years the masters of medical

[3] DuLaurens (Laurentius), A. Historia anatomica humani corporis et singularum eius partium multis controversiis observationibus illustrata. Paris, M. Orry, 1640.

[4] Riolan, J. Opera omnia. Paris, Ex officina Plantiniana, 1610, p. 132.

Europe. Vesalius was followed by Falloppio; then came Fabricius ab Aquapendente and he made an anatomist out of his servant Casserius. He, on the other hand, was followed by the Flemish doctor Adrian van der Spieghel, and Spieghel's friend Vesling continued the tradition. His pupil Molinetti also belonged to the esteemed masters of his time.

As the perfect anatomical engravings of Eustachius had to wait one hundred fifty years before being published,[4a] the beautiful tables which Casserio edited[5] and which show handsome youths and dignified gentlemen displaying their muscular layers in classical landscapes, contain the first reproduction of the adrenals to be published; they were called "corpuscula reni incumbentia sive reni succenturiati." The corresponding vessels are represented here for the first time also. As accompanying text, the *De humani corporis fabrica libri X*[6] of Spigelius was used and it contains twelve lines about these mysterious organs which run: "The glands, described by Eustachius in our times . . . are half-moon shaped and they resemble the kidneys. Their substance however is somewhat softer . . . they receive their nerves from the plexus, formed by stomach and rib-nerves by means of many fascicles. I think they serve to fill the vacuum, which is situated between kidneys and diaphragm and they support the stomach where it approaches veins and arteries of the kidney."

At that time Casper Bartholin, a young man from Malmö, studied in Padua. He was not yet thirty when he was asked to teach philosophy at the University of Basel, Greek at Montpellier, and anatomy at Naples. Finally, as professor of theology he became ancestor of the family which ruled the University of Copenhagen for one hundred years; his son Thomas published an excellent description of lymph-vessels and his grandson, of Bartholin's glands—and as a consequence they are often mixed up. Caspar Bartholin gave in his intelligent little booklet *Institutiones anatomicae*[7] a new name to the new glands, starting thus an almost endless discussion. He called them "capsulae atrabiliariae" and writes:

> These vessels are overlooked by many and many do not heed them, but they are to be found in all bodies, whatever Archangelus, who compares them to the sixth finger, may say . . . we call them, because of the function we attribute to them, the capsules of black bile . . . they contain a cavity, which holds a dark and faeculent liquid. Their use is still unknown. But if it is permitted to utter conjectures, which

[4a] Tabulae anatomicae Barth. Eustachii, quas a tenebris tandem vindicatas praepatione notisque illustravit ac publici juris fecit. Rome, J. M. Lancisi, 1714.

[5] Casserius, Julius. Tabulae anatomicae LXXVIII. Venice, 1627.

[6] Spieghel (Spigelius), A. van der. De humani corporis fabrica libri X. Opus posthumum. Venice, 1627.

[7] Bartholin, Caspar. Institutiones anatomicae. Ed. IX. Goslaria, 1632.

we, after having examined their structure and achievements, are entitled to do, we say, that these capsules contain a bile-like, thick excrement; like liquid prepared by the blood of the liver, by the blood of the spleen, or both, or mainly by the spleen. In the cavity the liquid is stored, because it cannot pass the straight channels [of the kidney]. Strong urine is dark, because pressure causes compression of this liquid; that may well be a reason for disease.

Whoever has carried out autopsies on not-too-fresh cadavers will understand why the young scientist reached these conclusions: the decomposed medulla is dark and soft, and therefore the name, once invented, was kept for a long time. It is remarkable that Bartholin thought about lesions of the adrenals as possible causes of disease—a theory which was confirmed about two hundred years after him.

The statement that the adrenals were "vasa" or "capsulae" gave rise to a new scientific discussion. Jean Riolan, the younger, who gained fame by excellent observations as well as his stubborn resistance to Harvey's theory of circulation, immediately attacked the description of the adrenals as hollow organs. "I have never seen a cavity in them," he affirms,[8] and adds: "Should they have a cavity, no pea would find a place in it." He enriched the knowledge about adrenals in the chapter "De foetu" of his *Anthropographia* by the discovery that they were relatively larger in fetal life.[9] Riolan's description did not settle the discussion; even Wharton, who discovered the excretory duct of the sublingualis, tried his best to prove the existence of a cavity. After the death of Spigelius the anatomical tradition of Padua was continued by Johann Vesling from Münster; he traveled through Palestine and Italy and lectured in Venice so successfully that the auditorium broke down under the weight of his public. His *Syntagma anatomicum*[10] was printed and translated in Padua, Amsterdam, and Frankfort and one hundred years later Morgagni still found: "Omnium manibus Veslingi syntagma versaretur." He described exactly the nerves and vessels of the adrenals, indicated that they are the size of a nux vomica, ascribed a small cavity to them, and discussed their color which sometimes is reddish but more often resembles fat. As to their function he modestly said, "What their use is, the human mind has not yet conjectured," but then boldly adds that they "probably favour the evacuation of the serous liquid and store the black bile which acts as a ferment, promoting the secretion of liquid from the blood. . . . They act like many small glands

[8] Riolan, J. Animadversiones secundae ad anatomicam reformationem Thomae Bartholini. Paris, 1655.

[9] Riolan, J. (*fils*) Anthropographia. Ex propriis et novis observationibus collecta, concinnata. Paris, Ex officina Plantiniana, 1625.

[10] Vesling, J. Syntagma anatomicum. 2d ed. Pavia, 1651.

which have arteries and veins and are formed by nature as imitators of the kidneys and have the shape of vessels."

Antonio Molinetti, Vesling's successor, dedicated considerable space of his *Dissertationes pathologicae, quibus humani corporis partes accuratissime describuntur*[11] to the adrenals and invented a new theory. "They are triangular," he taught, "and look like a bishop's hat . . . they contain many nerves and particularly tender ones, which come from the plexus mesentericus, so that the attentive scientist has no doubt about the fact that they were hidden for certain reasons. The anatomists know nothing nor have I anything I can put foreward as likely. . . ." He then listed the theories of Riolan and Caspar Bartholin and continued: "Some claim that their liquid produces effervescence in the left ventricle, and I would gladly consent if I could only show anatomically how his acid humor reaches the heart or the kidney. That cannot take place through the arteries because they bring liquid and do not carry it away, nor by the veins, if the fluid in them does not stream back . . . and even if the liquid would reach the heart through the veins, it could not immediately flow into the left ventricle, but had to stream through the lungs, with all the changes that involves, and it is unlikely that a substance mixed with so much blood could cause effervescence . . . it would be an unconsidered hypothesis . . . to ascribe such an effect to a liquid."

The illustrious scientist could certainly not surmise that adrenalin acts upon the heart in incredible dilutions and he therefore advanced a hypothesis based upon the relatively exaggerated size of the suprarenal gland in the fetus: "If we are allowed to say our own opinion among so many eminent men," he began, and then explained "that the foetus would quickly fill the space he is swimming in with urine . . . and that is the reason why a wise nature avoids this disaster; she has created bodies to catch the blood and lead it away from the kidneys in order to lead it back into the veins as quickly as possible . . . in order to be cleaned in the body of the mother from the serous excrements . . . so that the pregnant urinate more frequently."

In the seventeenth century the Italian monopoly in anatomical science appeared seriously threatened; in 1659 Thomas Wharton in London published the first monograph dedicated to glands alone—his *Adenographia.*[12] He began his long chapter on the adrenals by suggesting a new name for

[11] Molinetti, A. Dissertationes anatomico-pathologicae quibus humani corporis partes accuratissime describuntur morbique singulas divexantes explicantur. Venice, P. Balleonius, 1675.

[12] Wharton, T. Adenographia: sive glandularum totius corporis descriptio. Amstelœdami, sumptibus J. Ravesteinii, 1659.

them: "Glandulae ad plexum sive glandulae ad plexum nerveum sitae." He quoted Bartholin and Vesling and emphasized the fact that in animals they are sometimes situated far from the kidneys; he objected to Riolan, who refused to accept the space in them and promptly put forward a new theory:

> What they contain cannot be entirely useless because it is currently absorbed into the veins. Useless stuff is brought to excretory organs and eliminated by openings. The substance is not identical with chylus, especially because suprarenal glands have a structure which differs from mesenteric lymph glands. The ramifications of the vagus nerve are "anchored" into the gland. These nerves are unusually thick. Although I am not quite sure, I think they bring a substance from the spleen and deposit it into these glands.

There is no other explanation for the rich connections between spleen and these glands, he thought. The substance brought by the nerves and apparently useless for them must have another use and a provident Nature has reasons to lead it back to the veins.

Wharton had never seen a disease of these glands, but "nihilo-minus, si coniecturae locus est [if he is permitted to advance a conjecture] obstruction in these glands causes a trouble in the liquids which render the nervous system weak and diminishes the tonus of the fibrous parts." A disturbance of the liquids [*colluvies serosae*] concerns the fibrous parts of the body and sows the seeds of many diseases. Although we cannot conceive nerves as vessels, we have to admire Wharton, who was the first to attribute atonia to a lesion of the adrenals.

A few years later (1672) a physician in Utrecht, Ysbrand van Diemerbroeck, undertook to review the most important physiological theories of his century.[13] He quoted Riolan jun., who attributed to the adrenals the task of forming the fat around the kidney "as otherwise the fetus is free from fat," and Wharton's pupil, Glisson, who surprisingly enough suggested: "that these glands separate a liquid from the rest of the blood which serves as nourishment for the nerves." He himself thought "the black liquid has the character of a ferment" and that it reached the cava flowing through the veins. The final statement of Diemerbroeck is the most interesting: "We hope that physicians from now on are going to examine these organs with more attention, in order to see which diseases may be due to them and explain their function by means of many autopsies and descriptions."

At that time Thomas Petrucci, who worked in the Santo Spirito Hos-

[13] Diemerbroeck, Y. van. Opera omnia medica et anatomica, partim iam antea excusa, sed plurimis locis ab ipso auctore emendata, et aucta partim nondum edita . . . nunc simul collecta et diligenter recognita per Timannum de Diemerbroeck, Ysb. fil. Geneva, S. de Tournes, 1687.

pital in Rome and perhaps in the same anatomical theater where Eustachius had made his discovery, published his monograph "on the structure and use of the renal capsules" (1675).[14] He named all those who had treated this topic before him and gave a list of their theories. He listed however, with evident pleasure, what everyone brought forth against his predecessor. As to the opinions of Caspar Bartholin, he shared the views of Gerhard Blasius who rejected them: "Black bile is an unnatural liquid, and although Nature, the wisest, has cared for everything it could not foresee the accidents and could not create a container for pathological liquids." He quoted Domenicus de Marchettis from Padua as an adversary of the atrabiliar theory: "Why should they be so big in fetal life?" He left it to Laurentius Baldini to fight the hypothesis of Vesling: "How should the liquid influence renal function? If it remains in the adrenals, it cannot do anything—if it enters the circulation, there is no way to lead it to the kidneys."

As to Spigelius, who meant the adrenals should be there to fill the space which would be empty without them, he proceeded in the classical way of scholastic philosophy. "What is a hole?" he asked, and replied himself: "Locus actu existens carens corpore cuius est capax." It follows that Nature was able to fill such a hole by air or a bigger kidney.

Finally Petrucci explained his own view and, possibly because his work is dedicated to a Cardinal, he began: "These capsulus, being a work of God Almighty, have to contribute to the beauty and utility of the mikrokosmos we call man. Like everything, they praise God. When do they praise him? When they are viewed with understanding eyes. . . ." Then he declared that only the Neoterici Circulatores—those who adhere to Harvey's theories —are able to conceive of their importance. (This part of the book is of particular interest for those who think that Harvey's discovery had destroyed the ideas of Galenus at once.) The blood circulates in order to return to the heart, to be reboiled and reheated, because the heart is the center of human heat. Now the heart cooks blood and (as it should be seen even by the eye-sick and by barbers = ut etiam lippis et tonsoribus patet) the truth is: "nulla concoctio sine excremento." The stomach concocts and prepares the stools, the liver concocts and prepares bile. Every excrement has a container (conceptabulum) and an outlet (excerniculum), such as the anus for the intestines, the urethra for the bladder. The adrenal gland is the "conceptabulum" for the concoction of the heart—and what seem to be

[14] Petrucci, Thomas. Spicilegium anatomicum de structura et usu capsularum renalium. Romae, Ex typographia F. Tizzoni, 1675.

their veins are conducts for the excrements of the heart, so that it would be just to call them "atrabiliary ducts."

In 1691 a student of Leipzig, Christian Ludwig Welsch, son of the famous anatomist Gottfried W. Welsch, obtained his medical degree by writing a monograph on the adrenals. He stated in his thesis[15] that they contain a cavity which is able to hold not only eight, but even twelve peas and that lymph-vessels lead into it. He contradicted a certain van den Cruyce who believed lymph would stream from the stomach into these glands, "because lymph streams to the big cisterna." He apparently had the courage to taste the black liquid in the medulla, and described it as "acid and astringent." It is likely that it was due to Welsch that the Germans adopted the term *Nebenniere* for the adrenals.

The expression used today exclusively in Italian- and Spanish-speaking countries, "glandula surrenalis," was created much later—1723—by Winslow who, although a Dane, taught anatomy in Paris.[16] His book on anatomy is dedicated to the philosopher Helvetius and written in elegant French instead of Latin. He wrote: "The ancients gave these bodies the name of capsulae atrabiliariae . . . I think it would be fitting to call them 'glandes surrenales' . . . they resemble the crest of a cock . . . and contain a space. The use is not quite clear, but the liquid they contain always shows the features of the bile. They are relatively big in the fetus and their volume decreases with age. These two phaenomena deserve attention."

An important contribution to the research on the "suprarenal glands" was made by the Bolognese professor Valsalva, a pupil of Malpighi in the eighteenth century. His notes were published by his pupil Giovanni Battista Morgagni, the "father of pathological anatomy."[17] He chose the form of the epistle, as did Voltaire who taught philosophy in letters, and wrote in a kind of Latin which resembled the vernacular of Bologna more than the language of Cicero. His work is characteristic for this type of learned literature: he discusses whether a verse in the Old Testament could be referred to the adrenals, he rejects on the same page the theory of Molinetti because these glands do not disappear as the umbilical cord, and does not believe that they are lymph glands because they contain too many nerves. The seventy-seven pages show clearly that we have reached a borderline between two ages.

Morgagni wrote a critical history of the research on adrenals; he

[15] Welsch, C. L. Examen renum succenturiatorum. [Thesis] Leipzig, 1691.

[16] Winslow, J. B. Exposition anatomique de la structure du corps humain. Paris, 1732.

[17] Morgagni, J. B. Epistularum anatomicarum 22 ad scripta pertinentium celeberrimi viri A. M. Valsalva. Venice, 1740.

laughed at Petrucci because he explained the word suc-centuriati as derived from sub-centuriati (organs situated under the belt) and then exposed the theories of his beloved teacher.

The experiments of Valsalva, controlled by "oculo microscopio instructo," seem really modern to us: he used guinea pigs (*porcelli Indiae*), falcons, doves, tortoises, and rats; he observed males and females separately, examined capons with particular care, and searched for connections between adrenals and sexual glands. He thought he had seen these connections (animadvertit tamen . . . ipsos cum testibus longe sensibilibus communicationem habere quam epidydimis corpus cum testiculo humano). His conclusions ran: "A very subtile and active liquid, which is being added to the semen to its great advantage is elaborated in this sort of kidneys, and therefore one has a strange feeling in this region after a too strong effusion of genitaly liquids [post nimiam genitalium laticum effusionem]. Therefore the rôle attributed by philosophers, physicians, and other authors to the kidneys in genital matters should be ascribed to these glands." Another paragraph said: "I think they produce in male and female a liquid which is necessary for fecundation."

Knowing something about the kinship between steroid-hormones, we cannot help admiring the foresight of Valsalva; but Morgagni was rather critical: "If there should be some connection between adrenals and genital system, I do not see why they are relatively bigger in the foetus, which is so far away from the time of fecundation." He is, however, not so critical as to suppress the views of an "unknown author" whose opinion he found among the notes of Valsalva and who wrote: "The liquid of the adrenals is equally important for both sexes. It is not like sperm, but something required by the constitution of the body—something which in both sexes is *commune veneris irritamentum . . . et praecipuam esse delectationis venereae et concupiscentiae officinam.*"

Morgagni as a pathologist was much interested in diseases of the gland, but wrote that in decades of research he had never noted hollow spaces or lesions. Quoting the literature, however, he reported a case which we easily recognize as an excellent description of hypernephroma; he finished his work with the last sentence of Diemerbroeck and the melancholic declaration: "We leave now, 170 years after Eustachius, the research work to those who know more about anatomy than we do."

The theories of Valsalva were not accepted. Boerhaave, at that time the most famed clinician, reproduced them briefly in the chapter "Economia animalis" of his *Institutiones medicae:* "Testibus iuvandis in semine

perficiendo famulari haecce organa"; but he believed "they help the venous blood which, by passing through the kidneys, is deprived of its liquid, dissolved, and salty parts, the same way the blood of the spleen helps the blood of the cava."

Albrecht von Haller, who wrote seven volumes on Physiology,[18] knew definitely that there are no anatomical connections between adrenals and testes; and he was far too critical to elaborate a theory he could not prove.

At the beginning of the last century there was no more room for fantastic ideas in the handbooks of medicine. The German *Encyclopaedisches Wörterbuch der medizinischen Wissenschaften*[19] published 1841 remarked dryly: "The adrenals have no excretory duct. They are therefore blood-glands, the use of which is still ignored." The Viennese professor of anatomy, Hyrtl, the great humanist and linguist, declared in 1894:[20] "For us who know their structures into their atoms, they are unsolved and certainly insoluble puzzles." When Hyrtl wrote this sinister prophesy, Dr. Thomas Addison at Guy's Hospital in London had long since (1855) published his book on *The constitutional and local effects of disease of the suprarenal capsules.*" In describing the symptoms caused by destruction of the adrenal cortex he had opened up the path of modern research.

As the recent discovery of cortisone and its effects shows, these successful researches are far from terminated. Their description, however, is not the task of today's historian.

[18] Haller, A. v. Elementa physiologiae corporis humani. Bernae, sumptibus Societatis Typographicae, 1765

[19] *Encyclopaedisches Wörterbuch der medizinischen Wissenschaften.* (Edited by Busch, Dieffenbach, Horn, etc.) Berlin, Verlag Veith und Comp., 1841.

[20] Hyrtl, J. Onomatologia anatomica. Wien, 1894.

The Self-Education of Young John Hunter*

FENWICK BEEKMAN†

The Self-Education of Young John Hunter

WHEN William Hunter joined Cullen at Hamilton in 1736, his little brother, ten years junior to him and known at home as Jockie, was only eight years old. Their father, the laird of Long Calderwood, was now an aged and infirm man, suffering from the pains of "gravel." Because of this, the responsibility of bringing up the youngest of the family rested upon the shoulders of the mother. But she had numerous chores in the dairy and about the farm as well as many household duties. Consequently much of the care of Jockie was passed on to his sisters who with their mother pampered and indulged the little fellow in all his wants and fancies. Being bright and understanding and determined in what he wanted, Jockie soon discovered he could easily obtain his way when denied whatsoever he wished by adopting tantrum tactics. This we have on good authority, as Dorothea Baillie, an older sister, informed her daughters of their uncle's childish behavior and they in time recorded the facts in letters which have been preserved. His famous niece, Joanna Baillie, writes of the following incidents:

> Being the youngest [of the family], and a very great favorite of his mother, whilst his father—who was an old man and suffering very much from disease for some years before his death—could attend to him but little, he was extremely indulged, and so humoursome that he would often, when a pretty big boy, sit for hours together crying when he could not get what he wanted; and could not be taught to read but with the greatest difficulty, and long after the age when other children read English fluently, and have made some progress in Latin. However great as his aversion was to his book, he was by no means considered as a stupid boy; and tho' retaining, long past the age when such things are tolerated, that childish habit of crying, when occasion called upon him he was bold and intrepid, . . .

In support of this last assertion, Miss Baillie recites an anecdote. When twelve years of age, it appears that during a visit to a neighbor one evening, a most terrible apparition with a face of the devil suddenly presented himself at the door of the cottage; the company became petrified with fright, that is all but Jockie who, though scared, picked up the fire tongs from the

* This is the fourth of a series of articles by the author on the formative years of those two great Scotsmen, William and John Hunter. The previous titles have been: "Long Calderwood, the birthplace of the Hunters," "William Hunter's education at Glasgow, 1713–1736," and "William Hunter's early medical education."

† New York, N. Y.

hearth and attacked the prankster, putting him to flight accompanied by his cries of pain.

In time John was entered in the local grammar school at East Kilbride, from which his brothers, James and William, had graduated with honors. He, however, did not shine in scholastic studies and had to be withdrawn in a year or so. An account of this experience has been passed down to us in a letter of his niece, Miss Agnes Baillie:

> He would do nothing but what he liked [she writes] and neither liked to be taught reading nor writing nor any kind of learning, but rambling amongst the woods, braes, &c., looking after birds'-nests, comparing their eggs—number, size, marks, and other peculiarities: whilst his two elder brothers had been to college, and got the same education that the sons of country gentlemen then got.

Leaving grammar school before his father's death which occurred in 1741, we are told "he remained an idle, uneducated boy upon his mother's hands, who . . . had, from her great indulgence, but little influence over him, notwithstanding he was by no means destitute of warm affection."

To further corroborate these facts we have the word of his brother-in-law, Everard Home, who writes in his biography of Hunter: "He was sent to the grammar-school, but not having a turn for languages, nor being sufficiently under control, he neglected his studies, and spent the greatest part of his time in country amusements."

Joseph Adams has construed these remarks of Home, when writing the biography of his friend, in quite a different form: "Hence, we are not surprised to learn, [he says] that from the period John was sent to school to his seventeenth year, his life passed without any improvement from education."

From this apparently arose the myth concerning John Hunter's laziness and lack of education during his formative years, a legend which has been passed down to the present time. John D. Comrie, author of the *History of Scottish Medicine,* writes in 1932 of John's early education in a most disparaging way, saying: "Somehow his early education was neglected, and unlike his cultured brother, William, was at the age of 17 able neither to read nor write." This, as the reader will observe, is contrary to the statement made by his sister Dorothea.

At the close of the last century, Stephen Paget repeats this fable as fact in his most excellent *Life* of John Hunter.

> Throughout his boyhood he was good at such games as the village afforded to boys, and observant of Nature; but deficient in self-control, idle, and ignorant—a great disgrace for a Scots boy living within walking distance of Glasgow College, whose father was a gentleman, whose brothers were studying law and medicine.

Let us examine some of these charges that have been made and see if they cannot be refuted. It is claimed he was idle, lazy, uneducated, did not try to improve his knowledge, and was ignorant. These are, indeed, rather serious accusations to be made against a lad who in after life was to prove himself one of the earliest outstanding scientists of the world. For it seems impossible to believe that an ambitious individual could have reached so great fame if he had not possessed, during the years of his youth, more than an ordinary desire to obtain knowledge in a subject of overwhelming interest to him. There is evidence, I believe, to prove this.

Let us first hear from the accused concerning his early education, as we are fortunate in having an account of it from his own pen:

> When I was a boy [he writes] it was a little reading and writing, a great deal of spelling and figures; geography which never got beyond the dullest statistics, and a little philosophy and chemistry as dry as sawdust, and as valuable for deading purposes. I wanted to know about the clouds and the grasses, why the leaves change color in the autumn. I watched the ants, bees, birds, tadpoles, and caddis worms. I pestered people with questions about what nobody knew or cared anything about.

Here we have the important facts concerning his supposed delinquency. In reality his mentality was as acute if not more so than any of his companions, but he was not tolerant of the school discipline and refused to exert himself in learning the prescribed studies. His interests were quite different from the subjects taught at grammar school; he wished to learn of the life which surrounded him on the farm, in the woods, or along the stream.

Perhaps this lack of desire to acquire the ordinary knowledge as taught in grammar school was due to the pedagogue in charge of the class, who may have been a man of little insight, not possessing sufficient interest, energy, or enthusiasm to arouse young Hunter from his lethargy and make him learn. As it was, the lad cared nothing for the instruction he received at school and craved knowledge in the study of nature. In this he could find none to assist him. For up to this time the Established Church of Scotland had controlled all teaching in the land, both scholastic and collegiate, and the theologians saw to it that little was taught except the elementary subjects in school and the humanities and church doctrines in college. Consequently, the average Scotsman of that day knew nothing of the natural sciences. However, John Hunter was not daunted by this, for a great perseverance was one of the traits of his remarkable character, and if he wished to gain knowledge on any subject, it was seldom that he gave up the investigation until the quest was completed.

It has been discovered that his writings during later life contain numerous references to observations made by him during his youth. Sir Arthur Keith has provided us with a list of these—the actions of both the domestic animals and the wild life about Long Calderwood—in his instructive and touching story of the family life on this farmstead, entitled "The Cradle of the Hunterian School." It is evident that finding himself thwarted in his desire to obtain instruction from others in the natural sciences and having little or no faith in the knowledge that might be obtained from books, he determined to educate himself by gathering facts through observation and placing them in the storehouse of his brain where they would be at hand for use at some future date.* He developed in this way, while still in his youth, the facility of making accurate observations.

Another attribute of his character was an inordinate curiosity, a curiosity which was not satisfied until he acquired an answer which was in every way consistent with the facts in the case.

> Curiosity is, indeed, a necessary part of scientific desire; but it is not the common curiosity which can be satisfied by heresay; which seeks only new things, careless whether they be true if only they be wonderful or personal, or whether, if true, they can be wrought into real or useful knowledge. Hunter is a type of the true man of science, in that he was always impelled by desire to obtain knowledge by intellectual exertion.

These are the remarks of Sir James Paget, a tremendous admirer of John Hunter but one of those who believed that his youthful years were wasted in idleness and were of little purpose in developing him for his later career, if we are to take him at his word, to wit:

> In the first twenty years of life he appears to have had no inclination to science or to the arts that minister to it, or, indeed, to any kind of intellectual pursuit. We find no tales of early enterprise, no childish love of nature, no signs of future mental power.

I believe we must differ with Sir James in both his statement of fact and in his reasoning. Was it not Hunter himself who tells us of his interests when a boy and to corroborate his statements do we not find references to many of his youthful observations within his works?

Continuing, Sir James makes a further statement which I think is open to doubt when he writes:

> It seems strange that a mind so remarkable as John Hunter's, so robust and self willed as it proved, should not have shown or felt its power till, as if by chance, it was

* This is not strange, as it is found that most of his observations which later found their way into print had been made a long time before their appearance. He seems to have been far from hasty in publishing his works, presumably fearing that he might transmit false information. In consequence he choose to take his time, in order through repeated review and study of his findings to be sure his expressed opinion was correct and would withstand the attacks of the critics.

> brought to scientific work. He had not lived in darkness or among dull people: his father was a shrewd and sensible man; his mother well educated; his two brothers were persons of remarkable mental power. With these, his mind had had opportunities of exercise and culture, but he had neglected them as to him useless. He had lived among the same wonders of the organic world, the same truths and utilities in nature as moved him, in his later years, to restless study; yet he seems to have given no heed to them. No desire of knowledge was stirred in him till he was under the influence of scientific minds. [That is, until he joined his brother in London.]

Again, it appears that the author has little or no evidence to justify these statements. John Hunter's intellect was so remarkably different from others that few understood him, even in later years, and in consequence such comparisons as have been made by Sir James are seriously open to question. It seems to me that it was during these years his mentality was being moulded through "intellectual exertion," as Sir James says; and it was because of the ignorance of the majority of Scotsmen of that day in subjects to do with the natural sciences that young Hunter was said to be idle and neglectful of his studies. I believe it can further be said that his intellectual power was so well developed by the time he reached London that his brother, already trained in scientific methods, was at once conscious of it.

If the above be true, it is evident that Sir James is in error as to the age that John Hunter formed the desire for knowledge in subjects which had to do with the natural sciences, as he continues by saying:

> The germ of this fitness was, we may believe, born in him, as in both his brothers; and when at length, it found appropriate conditions of its life, it developed and grew into true grandeur. But this natural fitness was wholly intellectual; there was, at first no love or desire in it; and so his mind had no motive power till it was set to its right work, and in right working found happiness.

This argument is refuted by the statement of John himself, when older, and by the word of his sister transmitted to us through his niece, Agnes Baillie. Paget's assumption is in part probably true, but it appears to have been during his boyhood that the love and desire for things in nature first appeared and the "motive power," spoken of by Sir James, "was set to its right work," and not as late in life as when John joined his brother, William, in London. The "motive power" was the inborn curiosity of the lad, and the work which gave him happiness were the facts obtained through observation; for it was then he commenced the habit of observing. Finding he was able to discover facts concerning the habits and behavior of animals through observation—information which appeased his curiosity and pro-

vided answers to his questions—he commenced to develop this method for obtaining knowledge. He then began to plan investigations in his chosen field of study; wherever he was, in farmyard, in woods, or in meadow, his mind was ever alert to make some observation of importance through which his knowledge of nature might be augmented and his curiosity gratified. This was a pleasure to him, as Sir James Paget points out: "To John Hunter there seems to have been no great intellectual happiness except in the study of living nature; and to this he was now first brought." Not during his twentieth year in London but much earlier, when of grammar school age, on the farmstead at Long Calderwood.

It may be said further, I believe, that becoming adept in this method of learning from nature, through investigation and the finding that statements contained in books were frequently misleading, he lost respect for the written word and began to depend entirely upon his studies of nature for the facts he wished to know. He commenced to develop at this time that spirit of skepticism which in after years became such a part of his personality, a very important possession for any true scientist. This exercise of mind increased his intellectual capacity and soon he gained confidence in the ability to solve nearly all the problems which his unusual curiosity brought before him in the laboratory of the great outdoors.

It is no wonder that those about him thought he was lazy, idle, and ignorant—they did not understand his character or personality and therefore could not have possibly comprehended that though he had failed at school he was enforcing upon himself an intellectual training in subjects beyond their grasp. The only way they knew to obtain an education was by attending school and then college; consequently, it was impossible for them to envisage this lad, while working in stable, cow-byre, or in the fields, among domestic animals or the denizens of wood or stream, as being ever alert to facts of nature which might provide him with an answer to some question, thus satisfying his curiosity and adding to his knowledge of animal life. Daily he was educating himself and forming a capacity for intellectual work in the field of natural science far greater than he could in any school or college of that day. Nor did his companions understand the moments when he was in mental concentration, and that while silent in thought he became oblivious to his surroundings. Probably they thought him in some idle daydream, building castles in the air. It was while Hunter was in such a trance that Sir Joshua Reynolds in after years caught a remarkable likeness of him on canvas.

The mind of this young Scots lad, it seems, was hungry for knowledge, and he obtained food to appease it in the school of nature. "The little farm at Long Calderwood is John Hunter's University," Sir Arthur Keith tells us, "there with eyes and ears as professors he learned the principles of Animal Economy." It is probable that he never could have reached the pinnacle of fame, as he did, had not it been for his remarkable inherited intellectual ability, which became apparent at an early age and was developed through dogged persistency during the years of his youth.

Yes, he was lamentably ignorant and lacking in knowledge of the ordinary subjects taught at that time in the grammar schools of Scotland, but he could read and write, for he had learned this during an earlier age at the hands of his mother. It cannot, however, be said he was uneducated, for his mind, as we have seen, had been far from idle during the years he should have attended grammar school and perhaps the College in the neighboring city of Glasgow. This self-imposed study of biological science in the School of Nature undoubtedly set in motion the development of that intellect which Henry Thomas Buckle has placed only one step behind that of another eighteenth century Scotsman, the great economist Adam Smith. It might be asked, could John Hunter have developed as he did had he submitted to the routine teaching at grammar school during these formative years? This surely should be answered in the negative, for it was during this period of his life that his mind was moulded into the form which later earned him the name of genius.

Thus John Hunter, by exerting his independence and breaking with the traditional educational system, gained the knowledge of animal economy which was to prepare him for the more advanced instruction he was later to receive from his older brother in London.

During the summer of 1748, John Hunter was sent to Glasgow to visit his sister Janet, who shortly before had married a Mr. Buchannan, a fine-looking, popular young man, with an engaging voice but little business ability and a tendency towards having a good time. It is stated by Everard Home that John was seventeen years old at the time, and later biographers have repeated this error. I say error, for Janet was married sometime in the spring of the year 1748 and she died on May 27, 1749; as John had been born on February 13 or 14, 1728, he must therefore have been twenty years of age at the time of his visit. Mr. Buchannan is said to have been a partner with other young men in the timber business. This has caused the slanderous Jessé Foot, who whenever possible went out of his way with no apparent

reason other than jealousy of John Hunter's ability, to make the following assertion:

> Nor shall I attempt to amuse with any anecdote of young Hunter, during his scholastic education; whether his genius was so unbridled and overbearing, as not to be brought to submit to the trammels of discipline; whether from that time he had fixed the determination, never to read, which he has been declared to continue during his latter days; nor whether he had any education, excepting such as those have, who are bound apprentice to a common trade.
>
> A wheelright or a carpenter he certainly was, until the event of William Hunter becoming a public lecturer in anatomy, changed the scheme of his future occupations, and determined him to accept the invitation of his brother: to lay down the chisel, the rule, and the mallet; and take up the knife, the blow pipe and the probe.

Let us glance over the record and find the true facts of the case. Probably the most trustworthy evidence is the word of his niece, Agnes Baillie, who had acquired her knowledge of this happening from her mother, John's older sister. This is what she says:

> He [Mr. Buchannan] had, along with others as partners, a large wood or timber-yard—where seasoned wood ready for building houses could always be had, and also, which was the custom of the times, wood of all kinds for making furniture, mahogany, walnut, and other sorts, properly seasoned for making the furniture: for in those days there was no such thing as an upholsterer. So in the wood-yard there were carpenters, of all sorts, for making tables, chests of drawers, book-cases, according to the taste of their customers: and those old antique wardrobes, with heavy carved work, now valued as antiques, were the workmanship of these branches of the trade.
>
> At his sister's marriage, Johnny, as they called him, being quite unsettled, was sent down to his sister's, to see what could be made of him. So it was natural, as he was very curious and ingenious, when it pleased him, to go frequently into the workshop, amongst the carpenters there, and try his hand, and I daresay he did: but no scrap of paper, or letter, or anything my mother ever said, gave the least intimation of anything as to his being bred to it. At any rate, he had but a very short time of it—for he went to stay with his sister after the marriage, and she died before the twelvemonth was over—and he returned before her death—so that he was but a few months with his brother-in-law, Mr. Buchannan— . . .

Drewry Ottley, an early biographer of John Hunter, gives quite a different explanation for this visit to his sister.

> When Hunter was about seventeen, he went to stay for a time at the house of his brother-in-law, Mr. Buchannan, under the hope of being able to assist in freeing him from the pecuniary difficulties into which his convivial habits and inattention to business had led him. It is probable that whilst here, Hunter, who prided himself on his manual dexterity, assisted his brother-in-law in his workshop, and that hence originated the statement made by Foot, that he had served as a millright or a carpenter.

The reader must agree that these authentic accounts of John Hunter's visit

to his sister refute the statement made with such certainty by Jessé Foot. It is evident that the author's warped mind must have conceived the tale in the hope that it might belittle Hunter in public esteem.

John Hunter was now on the verge of manhood—a healthy young specimen, although there had been a number of his sisters and brothers who had suffered from tuberculosis. His body was strong and active as compared with his brother's slim torso and graceful carriage. He was five feet, two inches in height, broad-shouldered with full deep chest and short neck. His hair was of a reddish hue and his countenance firm, though not finely chiseled as that of William.

Let us now turn to Everard Home to inform us of the events which led up to John's departure from Long Calderwood and of the journey to London:

> Tired of living idle in the country he began to turn his mind to some more active employment; and hearing much of the reputation which his brother William had acquired as a teacher of anatomy, he wrote to request that he would allow him to come to London upon a visit, making at the same time an offer to be his assistant in his anatomical research; or, if that proposal should not be accepted, expressing a wish to go into the army. In answer to this letter he received a very kind invitation from his brother, and immediately set off for London, accompanied by Mr. Hamilton, a friend of the family who was going upon business; they rode up together on horseback.

Stephen Paget states that his companion on the journey was Francis Hamilton (whoever he might have been) but does not inform us whence he obtained his information. Sir Arthur Keith has his own opinion concerning who this Mr. Hamilton might have been:

> I have more than a suspicion it was Mr. Thomas Hamilton—Dr. Cullen's partner —the younger brother of Dr. Robert Hamilton, professor of anatomy in the University of Glasgow. We know, at least that Thomas Hamilton went to London then and studied and dissected with William Hunter during the winter 1748–49, and afterwards succeeded his brother in the Glasgow Chair.

The journey which took from ten days to two weeks time, was made on horseback. There were no stage coaches running between Scotland and London at that time, for the roads were impassable and the only vehicles were carts for carrying goods and a very occasional privately owned hackney coach. The poor people walked.

References

ADAMS, JOSEPH. *Memoirs of the life and doctrines of the late John Hunter, Esq.* London, 1817.

BAILLIE, AGNES. See Stephen Paget.

BAILLIE, JOANNA. See Stephen Paget.

BEEKMAN, FENWICK. Long Calderwood, the birthplace of the Hunters. *Bull. N. Y. Acad. Med.*, 1943, *2nd ser. 19*, 849–864.

BEEKMAN, FENWICK. William Hunter's education at Glasgow, 1731–1736. *Bull. Hist. Med.*, 1944, *15*, 284–297.

BEEKMAN, FENWICK. William Hunter's medical education. *J. Hist. Med.*, 1950, *5*, Part I, 72–84; Part II, 178–196.

BUCKLE, H. T. *History of civilization in England*. London, 1872.

COMRIE, JOHN D. *History of Scottish medicine to 1860*. London, 1927.

FOOT, JESSÉ. *Life of John Hunter*. London, 1794.

HOME, EVERARD. A short account of the life of the author. In: John Hunter's *A treatise on the blood, inflammation, and gun-shot wounds*. London, 1794.

KEITH, SIR ARTHUR. The cradle of the Hunterian school. In: *Contributions to medical and biological research, dedicated to Sir William Osler*. New York, 1919, vol. 1, pp. 88–110.

OTTLEY, DREWRY. The life of John Hunter, F.R.S. In: James F. Palmer's *The works of John Hunter, F.R.S.* London, 1835, vol. 1, pp. 1–198.

PAGET, SIR JAMES. *The Hunterian Oration . . . at the Royal College of Surgeons of England on the 13th of February 1877*. London, 1877.

PAGET, STEPHEN. *John Hunter*. London, 1897.

PEACHEY, GEORGE C. *A memoir of William and John Hunter*. Plymouth [Eng.], 1924.

The New History of Medicine

A Review

GEORGE ROSEN

FOR more than two thousand years medical history has been studied and interpreted in some form. During this period, the purposes motivating those who concerned themselves with the past of medicine and the evaluations derived from the materials available to them have varied considerably. Throughout Antiquity and indeed far into modern times such writing was motivated by a doxographic interest, by a desire to learn and to present the opinions and methods of previous medical generations. The essential purpose behind those writings is perhaps closer to that of the modern writer of a medical paper, who cites his immediate predecessors in the particular field of activity, than it is to that of the historian.

The rudimentary medical historiography of the Middle Ages was little better, consisting in general only of lists of names and works compiled seemingly without any sense of time or place. These modest evidences of medical history in the medieval West are contained in the introductions to medical works where the beginnings of medicine and the first healers are discussed. For the medieval medical writers the opinions and dogmas of their predecessors were still matters of contemporary concern, to be analyzed, discussed, and compared so as to dispose of any contradictions. A decided advance in the writing of medical history was achieved, however, in the medieval Orient by the Syrian physician Ibn Abi Usaibi'a (1203–1269). In a work entitled "Sources of Information on the Classes of Physicians," which probably first appeared in 1243–44, he collected all the available biobibliographical information about famous physicians. However, this comprehensive work does not seem to have affected the medieval medical literature of the West.

As the Middle Ages waned, it remained for the Renaissance to establish medical historiography and to provide it with a basic idea that has remained prominent to the present. The interest of Renaissance writers was focused primarily on the biographies and writings of famous physicians. In considerable measure this biobibliographical trend represents the influence of humanism, particularly of medical humanism, as well as the interest in individual personality characteristic of the Renaissance. Medical history was thus started on this path which it was to follow for centuries. The ap-

proach was developed through the seventeenth century, reaching its culmination in the "learned" historiography of the early eighteenth century.

The Enlightenment contributed a new element to the basic biobibliographical trend. The effect of this social philosophy became apparent with the rise of "rationalist" historiography. The most important innovation of the school was to broaden the scope of historical study by including the history of civilization in its widest aspects. Medical historiography could not remain immune to this trend. Clearly, medicine as an aspect of human culture also had to be included within this conceptual scheme. No longer was it enough to relate the lives of famous doctors and to review their works. Sprengel, the outstanding exponent of this viewpoint, stated that as far as possible the history of medicine must be related to general cultural history, and its chief concern should be the development of medical science.

Albrecht von Haller developed this new approach to the writing of medical history. Le Clerc, in his *Histoire de la médecine* (1696), had referred to the "uses which can be made of medical history," and Haller shared the same point of view. He wanted to learn from the medical past, and this *pragmatic* approach is characteristic of medical historiography in the age of Enlightenment. The pragmatic trend in medical historiography first showed itself in England, but it was in Germany under the influence of Haller that it achieved its fullest development. Pragmatic historiography and the various works in which it manifested itself culminated in Kurt Sprengel's *Versuch einer pragmatischen Geschichte der Arzneykunde* (5 vols., 1792–1803). Together with the other pragmatists of the eighteenth century, he saw the history of medicine as a process determined by geographic, political, social, and psychological factors. Above all, to understand the history of medicine it was necessary to know the history of the human mind, that is, the dominant philosophical systems of different periods.

The idea of development and the emphasis on the relation between medicine and philosophy were taken up, and carried further, by Sprengel's successors in Germany. This emphasis on philosophy at a time when the great idealistic systems of Fichte, Schelling, and Hegel dominated German thought does not come as a surprise. Eventually the philosophical trend overshot the mark and began to produce fantasy rather than history. By emphasizing the principles of continuity, development, and interrelatedness, however, the philosophical influence left a clear imprint on medical history.

By the 'forties of the nineteenth century, the inadequacies of philosophical history had been recognized, and medical historians turned from metaphysical speculation to the study of source materials. This change was clearly influenced by the view of Ranke that the historian must study the past with complete objectivity and relate past events as they actually happened. In fact, it was in Germany that J. F. K. Hecker first undertook to carry out the program of the modern historical school, to scrutinize all the sources, and to deal impartially and objectively with every aspect of the past. This striving for objectivity and an understanding of the past on its own terms was not entirely achieved by Hecker, but two other historians, Charles Daremberg and Heinrich Haeser, did put these principles into practice with considerable success.

During this very period, however, when medical history was finally placed on a satisfactory methodological foundation, the pragmatic element in the history of medicine was relegated to the background. Medical history engaged the interest of philologists and other non-medical scholars, and tended more and more to become an independent discipline. There seemed to be little or no need to relate medico-historical studies to problems of contemporary medicine.

In a brief survey such as this it is impossible to do justice to the many aspects of medical historiography in our time. The rise of various auxiliary sciences, such as archeology, paleography, and epigraphy have enriched the content of medical history. The elucidation of Egyptian papyri and Babylonian clay tablets has placed the early history of medicine on a firmer base. Archeological discoveries and the uncovering of hitherto unknown civilizations, as at Mohenjo Daro in India, have opened new vistas to the medical historian. Simultaneously, the development of the social sciences has made possible within recent years their fruitful application to the investigation and writing of medical history.

For the most part, however, this newer knowledge was not incorporated into a synthetic interpretation of the development of medicine. The historiography of medicine continued along the well-trodden paths developed from the sixteenth through the nineteenth centuries. Biobibliography, medical theory, literature, and practice have been the chief foci of interest. A few historians, such as Baas and Pagel at the turn of the century, took account of the significance of social and cultural influences in medicine, but no appreciable change was affected in the basic orientation of medical historiography.

Medicine, however, was not standing still. Under the pressures of

scientific advance, industrial change, demographic developments, war and shifting economic conditions, medicine branched out in new directions, and modes and conditions of practice began to change profoundly. In response to these changes, there developed an awareness that the responsibilities facing the physician required that he have a clear understanding of the medical past and present in order to be able to face the future intelligently. To this end, it is believed, the history of medicine can make a substantial contribution. By showing whence medicine came and where it stands today, medical history can make clear the forces that shaped the present and which must be taken into account in molding the future.

How adequately this task is performed depends to a very large degree on the point of view from which it is approached. The medical problems of the present are concerned at bottom with the social relations of medicine. Medical activity, whether research, teaching, writing, or practice, has as its ultimate aim the provision of medical care, in considerable measure a result of social organization. This situation has once again brought into prominence the social character of medicine, and has led to a recognition of the need for a reinterpretation of medical history from this broader viewpoint.

Efforts to apply this approach to medical historiography have now been in progress for some three decades. Numerous papers and several books have appeared in which aspects of medical history have been studied in terms of the institutional structures and social situations within which they occurred. For example, Richard H. Shryock in his *Development of Modern Medicine* and *American Medical Research* studied certain major developments in the history of medicine in relation to the action of preceding and concurrent social factors. The present writer in his *History of Miners' Diseases* investigated a specific occupational group and its health problems in terms of living conditions, social position, and occupational technology, and the relation of medical knowledge and practice to these problems. A similar point of view is manifest in Erwin H. Ackerknecht's *Malaria in the Upper Mississippi Valley 1760–1900*. No one, however, undertook to apply this theoretical approach to the history of medicine as a whole. Now, with the appearance of the first volume of Henry E. Sigerist's *History of Medicine*,[1] it is possible to envisage what a complete social history of medicine will be like.

The keynote of Sigerist's work is the proposition that medicine is an

[1] Sigerist, Henry E. *A history of medicine*. Vol. I. Primitive and archaic medicine. New York, Oxford University Press, 1951. xxi + 564 pp. Illustrated. $8.50.

activity whose development can be most fully understood only when considered in relation to the network of social interaction within which it occurs. Taking the social character of medicine as a point of departure, the history of medicine becomes the history of human societies in their struggle against disease. Thus, while Sigerist's first volume covers only a few ancient societies, it nevertheless sets a new pattern of medical historiography.

This volume consists of four sections. The first is a methodological introduction dealing with the historical approach to medicine and with problems of the history and geography of disease. It is a statement of policy to cover the entire work which is planned to appear in eight volumes. As a presentation of the theory underlying the new history of medicine, this section is clear, precise, and to the point. It is essentially the program of the social school of medical historiography. But, as with any other theory, proof of validity can come only in practice, and this proof is provided in the three succeeding sections.

The second section is concerned with primitive medicine. Included under this heading are two distinct but related themes, the medicine of pre- and protohistoric men, and the medicine of preliterate groups. Connecting these is the thesis that health and medical conditions among prehistoric men "were probably similar in many ways to those we find among some of today's primitive peoples." It must not be forgotten, however, that preliterate peoples have a long history and present a wide variety of cultural patterns, so that the medicine of today's preliterate groups cannot, without qualification, be equated with prehistoric medicine. Nevertheless, careful but imaginative use of available materials does throw light on prehistoric health problems and practices, and Sigerist exploits his source materials with great skill and judgment.

The study of medicine among today's primitives has other values too. The development of anthropological theory has made it possible to understand more clearly the place of health problems and medical practices in the cultural configuration of the group, and the study of simpler groups throws light on some of our own problems. Furthermore, within the context of the primitive group it is easier to study the dynamic aspects of medicine as a social function. Employing these principles, Sigerist deals with primitive ideas on the causation, nature, and prevention of disease, the position of the sick person, the medicine man, and then diagnosis, prognosis and treatment. This section on primitive medicine is a well-integrated presentation based on good anthropological materials. With its appearance, earlier accounts in histories of medicine have become obsolete.

The medicine of ancient Egypt occupies the third section. After briefly outlining the setting of Egyptian medicine in time and space, Sigerist examines the social environment. This brings him closer to the medical field because in treating of daily life, labor, and recreation it is necessary to bring into focus conditions conducive or inimical to health, as well as attempts to promote health and prevent disease. Once these elements have been discussed, the ground is prepared for a discussion of the way in which the Egyptians acted when an individual's health broke down and he became sick. In his discussion of primitive medicine Sigerist shows how inextricably magical, religious, and empirico-rational elements are combined in it. In Egyptian medicine these elements are again encountered, but while they are frequently combined, a separation has taken place so that there are different systems of medicine, overlapping here and there, but generally operating side by side. With these systems Sigerist deals in two brilliant subsections, one devoted to magico-religious medicine, the other to empirico-rational medicine.

In ancient Egypt, as among primitive peoples and in most early civilizations, the average person obtained a sense of security by knowing that he was at peace with the world of the gods and the spirits. When an individual fell sick, he found himself out of harmony with this transcendental world as well as with the world of daily life. Here magic and religion in a variety of forms provided ways to regain this state of well-being and security. Prayers, incantations, rituals, and similar treatments were available.

The sources of Egyptian medicine are very scanty and we cannot be sure that the documents available to us are at all representative. Nevertheless, through a judicious use of the evidence it is possible to reveal the general outlines, the pattern of Egyptian medicine. Sigerist discusses the various extant papyri, and then goes on to show what these indicate about the practice of medicine, including diagnosis, prognosis, and treatment. With these topics, as well as a brief discussion of medical theory, Sigerist concludes his account of ancient Egyptian medicine.

The final section of this volume deals with medicine in ancient Mesopotamia. Here, too, the culture is located in space and time, the social and economic structure of Mesopotamian society is outlined, and the principles and sources of Mesopotamian medicine are analyzed. Undoubtedly, there are many clay tablets still unread which may clarify and enlarge our knowledge, but Sigerist is able to present a clear and coherent outline. Babylonian medicine was religious in its general outlook, but as in Egypt there was a definite empirical and rational element. These aspects are skilfully delineated, and we see how they bear on the behavior and position of patient

and physician. A very interesting point is Sigerist's analysis of the theological origin of the concept of contagion, an idea which through the medium of Judaism was destined to play a very important rôle in Western medicine.

Four bibliographic appendices bring the volume to a close. These deal respectively with histories of medicine, source books of medical history, museums of medical history, and the literature of paleopathology since 1930.

The entire presentation is clear and lucid and reads well. It is obviously a work that has been in preparation for many years, a work about which the author has thought a great deal, and which represents the result of extensive and penetrating research. Henry Sigerist has, in a sense, worked all his life at the creation of this *History of Medicine*. Equipped with a wide knowledge of languages and of biological and social science, and with twenty-five years of research and teaching behind him, he has been able to synthesize these various elements in terms of a clear-cut philosophy of history. With the appearance of his first volume it is clear that the social history of medicine has come of age. As further projected volumes of this monumental work appear, Sigerist will more and more be for our time what Sprengel was in relation to the pragmatic medical history of the eighteenth century, and Sudhoff and Neuburger to the philologically oriented history of the late nineteenth and early twentieth centuries.

In the spiral of historical development we have come once more to a recognition that medical history can serve as a guide to the problems of medicine. To do so, it must adhere to the truth of history, and endeavor to see medicine not only from the viewpoint of the medical profession but of society as well. In this way the medical historian can contribute to medical progress, and to this important task Henry E. Sigerist has set his hand. The first fruits of his labor are now before us, and we look forward with pleasure and anticipation to the further progress of this new history of medicine.

Notes and Queries

Edited by Ralph H. Major, M.D.,* *and*
Dorothy M. Schullian, Ph.D.†

In Honor of Hippocrates

It is gratifying to note the prominence given in the general press to the ceremonies attending the gift by the Greek Government of several slips from the celebrated plane tree on the island of Cos beneath which, according to legend, the Father of Medicine used to meet his pupils some twenty-five centuries ago. The slips were presented to such cities as Paris, Rome, Oxford, Cambridge, and Madrid. Those for Paris were set out with appropriate solemnity on 6 April 1951, in the garden of the Faculté de Médecine. In the issue of the *Illustration* for 5 May 1951, Professor Léon Binet prints some of the remarks made on that occasion by Dr. Gerasime de Loverdos, representative of the Greek Government, and his own response. The symbolic significance of the gift for medicine and for Franco-Greek friendship was stressed.

Bibliotheca Walleriana

This department carried in the Spring 1951 issue, page 261, a report concerning the transfer to Upsala University of the renowned library of Dr. Erik Waller. It is a pleasure to add now that Hans Sallander, who in 1949 undertook the cataloguing of the Waller Library, has almost finished his task and has issued, pending the publication of the entire catalogue, an informative account concerning the principal treasures of the library. The account, running to twenty-six pages, appears in *Nordisk Tidskrift för Bokoch Biblioteksväsen,* 1951, *2;* it supplements earlier accounts by E. Starkenstein in *Philobiblon,* 1938, *10,* 305–334 and by S. Lindroth in *Svenska Bibliotek* (Stockholm, 1946), 159–216. The reader is impressed not only by the rarity of the printed items listed but also by the sparkling brilliance of the inscriptions which adorn them in so many cases. In the autographs of such pioneers of medicine as Ellenbog, Münzer, Pol, Fracastoro, Harvey, de Graaf, Laennec, Cotugno, Rolfinck, Gesner, Aldrovandi, and Tagliacozzi modern historians and bibliophiles will find a rather special inspiration.

Whipple Museum of the History of Science, Cambridge, England

The English journal *Nature* for 2 June 1951 carries notice of a new museum for the history of science which will be of much interest to historians of medicine.

In 1913, Mr. R. S. Whipple, chairman of the Cambridge Scientific Instru-

* Department of Internal Medicine, The University of Kansas School of Medicine.
† History of Medicine Division, Army Medical Library, Cleveland, Ohio.

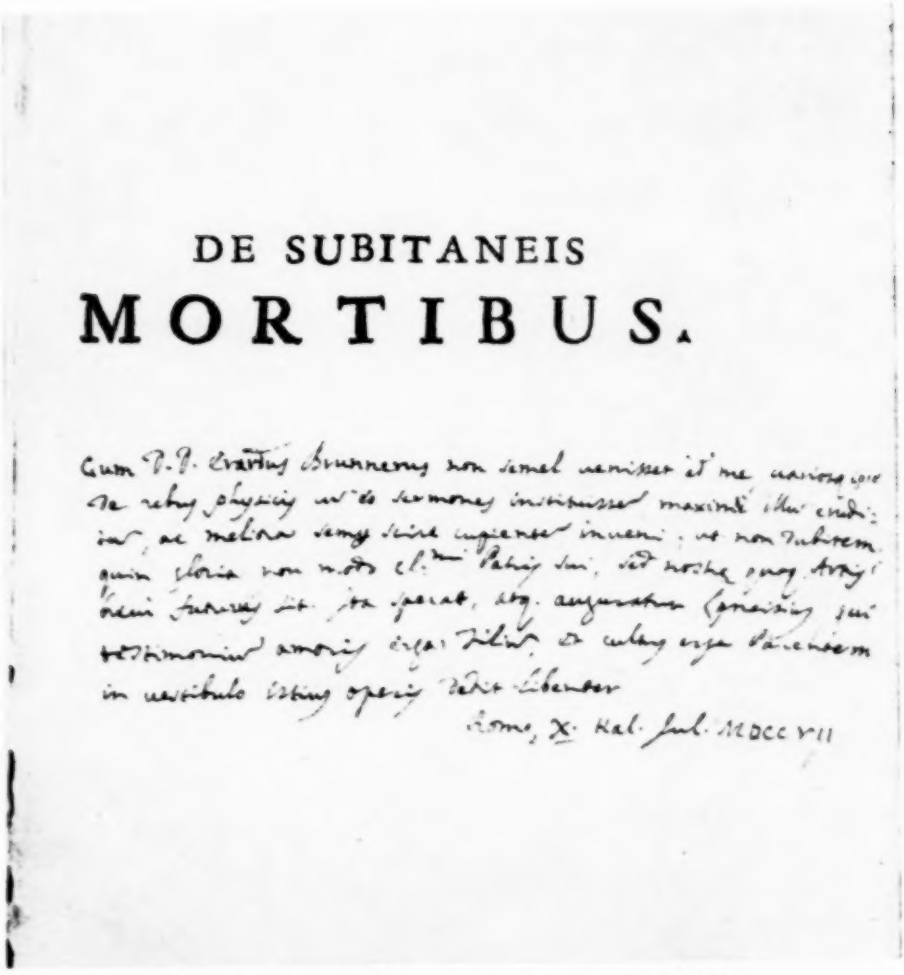
ment Co., Ltd., began a collection of instruments and books illustrative of the history of scientific instruments since the Renaissance. By the outbreak of World War II the collection numbered a thousand instruments and more than a thousand books and was especially rich in armillary spheres, astrolabes, nocturnals, quadrants, octants, sextants, telescopes, spectacles, sundials, microscopes, surveying instruments, levels, compasses, and drawing and mathematical instruments. Presented to Cambridge University in 1944 and enriched since by various gifts and loans, it was formally opened on 5 May at No. 14 Corn Exchange Street in the presence of its principal donor.

All who have worked to achieve academic recognition for the history of science as a branch of study will extend best wishes for the future development of the Whipple Museum. With similar museums in Oxford and elsewhere in Britain, in such Continental centers as Florence, and in this country it should take its place as a focal point for investigations in the history of science.

A Medical Historian in Africa

During a recent tour in Africa, extending over a period of four months, Dr. Douglas Guthrie, Lecturer on History of Medicine in the University of Edinburgh, discharged the task with which he had been entrusted, that of conveying to various centres of culture messages of greeting and good will from Edinburgh University.

The Faculty of Medicine at the University of Cape Town was modelled upon that of Edinburgh, and many members of the staff are Edinburgh graduates. Indeed, on the occasion of Dr. Guthrie's visit an "Edinburgh dinner" was attended by over thirty medical men who had studied in Edinburgh. On 17 January 1951, a joint gathering of the University Staff, the South African Medical Association, and the Post-graduate Association was held in the University. Principal Davie presided, and Dr. Guthrie delivered a lecture on "History of Medical Education." The next centre to be visited, on 26 January, was Johannesburg, where the University of Witwatersrand is located. Although this university is of relatively recent origin, here also Edinburgh graduates have formed a large proportion of the staff, and it was significant that the students, in inviting Dr. Guthrie to give a lunch-hour talk, suggested that the subject should be "Edinburgh's Influence upon Medical Progress in South Africa." Dr. Guthrie also lectured at the University, when Principal Raikes presided, and at the home of the South African Medical Association, where there was a large gathering. At Bulawayo, Rhodesia, on 5 February, and at Nairobi, Kenya, on 2 March, he addressed the local branches of the British Medical Association. Proceeding to Uganda he visited Makerere College, Kampala, now so well known as a centre of African education. He gave a brief address on "The Aims of a University" at the opening meeting of a new session of the College on 19 March, and led a discussion, by medical students of the College, on "Responsibility in Medicine," Professor Alexander Galloway presiding.



DE SUBITANEIS

MORTIBUS.

Cum P. P. Erattus Brunnensis non semel monuisset ut me maxime quo de rebus physicis ut ea sermones instituissem maxime illis eruditis, ac meliora semper scire cupientes inveni: ut non tubrem quin gloria non modo Cl.mi Patris sui, sed morbi quoq. Atrij Vrbevetani Iatrorum sit. Ita speravi, atq. augurabar Ignatius sui testimonium amoris erga filium, et cultus erga Patronum in vestibulo istius operis dare Libenter

Romæ, X. Kal. Jul. MDCC VII

Fig. 1. Lancisi, *De subitaneis mortibus*, 1707. Half Title.
(Courtesy Army Medical Library)

Dr. Guthrie's tour came to an end in Khartoum when, on 5 April, he lectured at the Kitchener School of Medicine on "Lord Lister in the Light of Modern Surgery." Like Makerere College, the Kitchener School grants diplomas which are of local value only, but it is hoped that when Gordon Memorial College is raised to university status, the School will become the Faculty of Medicine. Already there are excellent facilities for clinical teaching in the hospitals of Kampala, Uganda, and Khartoum, Sudan.

An Inscription by Lancisi

For those who truly love books the value of a rare item is considerably enhanced by the presence of a signature or inscription in the author's hand. When such a notation constitutes in addition source material for some phase of history it gains correspondingly in importance. Medical historians will be interested to know of the following inscription (Figure 1) in the Army Medical Library's copy of the first edition of Lancisi's *De subitaneis mortibus*:[1]

Cum Dominus Dominus Erardus Brunnerus non semel venisset ad me uariosque ipse de rebus physicis cum eo sermones instituissem, maxime illum eruditum ac meliora semper scire cupientem inueni, ut non dubitem quin gloria non modo clarissimi patris sui, sed nostrae quoque artis breui futurus sit. Ita sperat atque auguratur Lancisius qui testimonium amoris erga filium et cultus erga parentem in uestibulo istius operis dedit libenter.

Romae, X. Kal. Jul. MDCCVII.

The esteemed Erhard Brunner has visited me on several occasions, and whenever I have sounded him out on medical subjects I have found him always exceedingly well versed but still desirous of learning more. I doubt not therefore that in a short time he will bring honor not only to his eminent father but also to our profession. This in fact is the hope and wish of Lancisi, who gladly sets down at the beginning of this work this testimony of his love for the son and his respect for the father.

Rome, 22 June 1707.

It is hardly necessary to review here Lancisi's prominence in the history of medicine. I have the assurance of Dr. Pietro De Angelis, Librarian of the Biblioteca Lancisiana, that the inscription is indeed in Lancisi's hand and not in that of a secretary. Erhard Brunner, born at Diessenhofen in 1682,[2] was the third son of the renowned Swiss physician Johann Conrad Brunner and of Magdalene Wepfer, youngest daughter of Dr. Johann Jakob Wepfer of Schaffhausen.[3] His inaugural dissertation, *De frequentia morborum in corpore humano prae brutis*, was presented at Halle on 15 June 1705.[4]

[1] Rome, 1707. Another autographed copy is recorded in C. E. Rappaport's Catalogue LXV, *Ars medica per saecula*, Editio altera, Rome, 1930, no. 278.

[2] J. M. Aepli, in Rahn's *Archiv gemeinnütziger physischer und medizinischer Kenntnisse*, 1787, Bd. I, Abt. 2, p. 448.

[3] N. F. J. Eloy, *Dictionnaire historique de la médecine*, 1778, *1*, 470; Conrad Brunner and Wilhelm von Muralt, *Aus den Briefen hervorragender Schweizer Ärzte des 17. Jahrhunderts*, Basel, 1919, p. 111. For the second reference I am indebted to Dr. W. P. Fuchs of the Universitätsarchiv, Heidelberg.

[4] The Army Medical Library has a copy of the dissertation (Halle, Chr. Henckel, 34 pp.). It was published, according to the *British Museum General Catalogue of Printed Books*, 1939, 27, col. 203, in Georg Ernest Stahl, *Dissertationes medicae . . .*, Halle, 1707, vol. 1, pt. 2, and in Joannes Paulus Giovannelli, *Miscellanea physico-medica . . .*, Florence, 1747, vol. 1. We have

There is a tradition that Erhard was in Rome in 1707 as assistant at the hospital of Santo Spirito and that he lived from April to June of that year at the Villa Medici.[5] Dr. De Angelis, whose unfailing kindness I gratefully acknowledge, has been unable to find in the archives of Santo Spirito any record of such an assistantship, and it is possible that Erhard frequented the hospital as observer only and not in any official capacity. The inscription, in any case, testifies soundly to the close relations between Lancisi and Brunner father and son and to the admiration which he had for both. Unfortunately the Biblioteca Lancisiana possesses no correspondence, earlier or later in date, between him and the Brunners. The promise which he saw in the son and expressed in the inscription could be only partially fulfilled, for Erhard died early, in 1721, six years before his eminent father.

DOROTHY M. SCHULLIAN

earlier evidence of Erhard's activity in Friedrich Gottfried Barbeck and Erhard Brunner, "De corde occulto, indeque hydrope ascite consequente, cultro anatomico in subjecto quodam deprehenso, Duisburg, 1701," published in Albrecht Haller, *Disputationes ad morborum historiam et curationem facientes*, Lausanne, 1760, 7, pp. 737–761.

[8] Friedrich Noack, *Das Deutschtum in Rom*, Berlin, 1927, vol. 1, p. 188; vol. 2, p. 110. This reference also I owe to Dr. Fuchs, who has in addition searched for some verification of the tradition that Erhard, like his father, taught medicine at Heidelberg University. His name, however, is not mentioned either in the manuscript list of professors which is preserved at the Universitätsarchiv or in two modern works on the University: E. Winkelmann, *Urkundenbuch der Universität Heidelberg* (Heidelberg, 1886); and Eberhard Stübler, *Geschichte der medizinischen Fakultät der Universität Heidelberg, 1386–1925* (Heidelberg, 1926).

Book Reviews

DOROTHEA WALEY SINGER. *Giordano Bruno, His Life and Thought,* with annotated translation of his work "On the Infinite Universe and Worlds." New York, Henry Schuman, 1950. xi + 389 pp., illus. $6.00.

MRS. SINGER wrote the first sketch of the present work in the library of the University of California at Berkeley. The return of the work in its completion to the place of origin, there to be reviewed by one who talked with Mrs. Singer about the task at its beginning early in the thirties, is a coincidence apposite to Bruno's delight in symbolism. The circle ends where it begins. The reviewer's remembrance of the spirit in which the work was undertaken is confirmed by the consummation. Here is a labor of love revealed in the detail with which the Nolan's career has been searched out, especially "the crucial and fruitful period in London" (1583–1585) during which were produced the treatises discussed in Chapter Four, "The Italian Cosmological Works," and Chapter Five, "The Italian Ethical Works." The history is also a labor of love in sympathy with the man and his thought which mounts to a climax in narration of his imprisonment and death, Chapter Seven, "Martyrdom (1591–1600)."

In Chapter Three, "Cosmology and Philosophy of Bruno," Mrs. Singer briefly characterizes the Ptolemaic scheme, relates Bruno's cosmology to sixteenth century astronomy, and then presents major themes of his philosophy under the headings: Cosmic Metabolism, Inherent Necessity, Coincidence of Contraries, and Bruno's Synthesis of Universal Relativity. Here, as in other chapters, the history of ideas entering into Bruno's thought and references to sources of actual or possible influence are brought before us. Thus the influence of Lucretius is brought out in Bruno's theory of "perpetual transmutation" in the flux of "prime indivisible bodies" (the living "minima" or "monads" constitutive of finite things) as well as in his doctrine of immanent necessity. Similarly, appreciative attention is paid to the "coincidence of contraries" in Nicolaus of Cusa and to the close correspondence of Bruno's views on the relation between finite and infinite and those of the Cusan. Bruno's devotion to the mnemonics of Raymund Lull is noted and deplored—"he wasted a great part of his energy and of his active career on this barren topic." Yet the Lullian symbolism, as Mrs. Singer recognizes, was esteemed by Bruno to be a lamp lighting the way to wisdom in the domain of natural magic. Why this should have been so is indicated in her quotation from Bruno's preface to his work *On the Composition of Images, Signs, and Ideas for All Sorts of Discoveries, Dispositions, and Recollections.* Bruno writes, "Idea, imagination, analogy, figure, arrangement, notation—this is the universe of God, the work of nature and reason, and is possessed by the analogy thereof so that nature may admirably reflect divine action, and human

talent may thereupon rival the operation of nature and almost reach yet more exalted things." It is nature "under various signatures" that "advances these forms and figures from the depth of potentiality to the sublimity of action. And, by immortal God, what can be easier to man than the use of number?" This reads very much as though Bruno, along with John Dee and some of his own Italian contemporaries, subscribes to a doctrine of seminal numbers constitutive of the fabric of nature. To man is given the privilege of observing the images "impressed and inscribed" and the power of reckoning the rules "of all things which can be uttered, known or imagined; all arts, languages, works, signs." (151–152)

Throughout the biographical chapters, as well as in the presentation of Bruno's views, Mrs. Singer has reconstructed the situations, dispositions, and derivations of his thought. These studies, in conjunction with her detailed expositions of the six Italian works and her annotated translation of one of them, *On the Infinite Universe and Worlds,* comprise a valuable contribution to Renaissance scholarship. She is careful not to claim, as some have, that Bruno is a martyr to scientific convictions and a forerunner of a scientific age. Bruno embraced the Copernican hypothesis of the two-fold motion of the earth but not, like Galileo, as a mathematician and scientist concerned with astronomy. Rather, the Copernican hypothesis figures as an argument in dialectical defense of a cosmology in which our sun is only one center, and our world only one among innumerable worlds, in a boundless universe. While asserting that Bruno "opened a new approach to interpretation of nature," Mrs. Singer also shows that his thought ran to metaphysics wherein he seeks to explicate how "God worketh all things in all things" and to ethical discourse about the potentiality and perfecting of the human soul and will in love of God. Aristotle, in the *De Coelo et Mundo* and the *Physica,* is the chief philosophical antagonist to be refuted in discussion of the infinite. Bruno proceeds argument by argument to prove to his satisfaction the vanity, emptiness, and error of "that fellow."

The account of "The Mediaeval Cosmic Scheme" (Chapter Three, "Cosmology and Philosophy of Bruno"), though too brief to do justice to the heading, suffices to indicate the nature of the Ptolemaic system and of the modifications introduced by Copernicus. Adequate attention is devoted subsequently to the cosmological arguments of Aristotle examined and rejected by Bruno. What, however, is the relationship of Bruno's thought to preceding scholastic philosophy? Mrs. Singer mentions that Bruno quotes St. Thomas Aquinas in support of his own views in the course of his defense before his examiners in Venice in the year 1592. Moreover, she points out that his youthful studies in the monastery included "the usual course of scholastic philosophy based on the works of St. Thomas which he always held in great reverence." In attributing to Bruno a "new philosophy" (i.e., "his real philosophic contribution was his realization and pursuit of universal relativity deriving from an infinite single universe"),

what was the relation of the new philosophy of his mature years to the scholastic philosophy studied in youth and subsequently in evidence in terminology and problems of his metaphysics and ethics?

Mrs. Singer tells us that "The infinity of time and space had been rejected by orthodox Christian thought in mediaeval Europe, but was more or less cautiously set forth in a whole body of Moslem and Jewish writings which were translated into Latin between the twelfth and fifteenth centuries. These conceptions were widely canvassed in the universities of North Italy and France and especially in Padua and Paris." (52) In this connection, she notes that Bruno often cites Solomon Ibn Gabirol (Avicebron) and Averroes, and that the latter's views on the eternity of the world and the unity of the world soul "fitted well with Bruno's cosmological thought." It would have been pertinent to mention that Averroes on the world soul had been deemed heretical and, directly to the point, to have inquired whether or not Bruno in his citations was identified thereby as perpetuating a condemned thesis. To see wherein Bruno's philosophy is new and in this in conflict with precedent thought, we need to know how and why eternity of the world and the single, universal, world soul were theses repugnant to Christian faith.

Common to both St. Thomas and Bruno is assertion of the infinity of God in keeping with the principle of plenitude. A perfect being cannot be in any way limited in that which flows from him. Bruno departs from St. Thomas in arguing that the universe deriving from God as prime source must be infinite in space and time. The principle of plenitude is invoked when Bruno writes as follows:

> For I do not insist on infinite space, nor is Nature endowed with infinite space for the exaltation of size or of corporeal extent, but rather for the exaltation of corporeal natures and species, because infinite perfection is far better presented in innumerable individuals than in those which are numbered and finite. Needs must indeed that there should be an infinite image of the inaccessible divine countenance and that there should be in this image as infinite members thereof, innumerable worlds, namely, those others that I postulate. But since innumerable grades of perfection must, through corporeal mode, unfold the divine incorporeal perfection, therefore there must be innumerable individuals, those great animals, whereof one is our earth, the divine mother who hath given birth to us, doth nourish and moreover will receive us back; and to contain these innumerable worlds there is needed an infinite space. (*On the Infinite Universe and Worlds*, 257)

The earth-centered and hierarchically graded finite universe of Dante and Aquinas could not be reconciled with Bruno's vision of a boundless spatial immensity. The picture of God enthroned above the *Primum mobile* with the heavens ranged concentrically beneath becomes unimaginable in an infinite universe, for there is no absolute "beyond" as station for a transcendent diety. Spirit, creative of all effects, pervades and animates all, but is nonetheless said to be primal, indivisible, and eternal. A book written to questions arising from an internal analysis of Bruno's thought would need to ask whether or not Bruno had found a way of asserting at once the eternity of the universe and its deriva-

tion from a prime source. In the main, this would be another and different kind of inquiry from that which Mrs. Singer was concerned to make. She has sought to present Bruno's biography and to represent the lineaments of this thought but only occasionally to carry analysis beyond expository delineation of themes into critical examination of arguments. It would still have been in train with her selection and emphasis to have had an account of the meanings which "infinite" assumes in Bruno's discourses. Such accounting could have suggested itself to her had she made comparison of Bruno and St. Thomas on the infinity of God in the course of her historical study.

For St. Thomas, infinity of God pertains to a transcendent substance and not to created things. Bruno, to the contrary, argues that "for the subsistence and perfection of the universe, an infinity of worlds is indeed necessary," and that there must be a space of boundless immensity to contain them. These worlds and all things in them are pervaded by God who, as prime mover, "giveth power to generate their own motions to an infinity of worlds." Active principles of motion are then differentiated, "the one finite according to the nature of the finite subject, and this moveth within time; the other infinite according to the nature of the soul of the world or indeed of Divinity which is as the soul of the soul which is all in all, and it createth the soul, all in all, and this doth move instantaneously." (*On the Infinite Universe and Worlds,* 267) A "necessity" for a created actual infinity of worlds in boundless space is arguable from immanent Divinity, but Bruno seeks to have his pantheism and transcend it too, e.g., "the infinite number and magnitude coincide with the infinite unity and simplicity in a single utterly simple and indivisible principle, which is Truth and Being."

Leonardo Olschki (*Giordano Bruno,* Halle, 1924) judges that Bruno oscillated between pantheism and theism. Mrs. Singer does not agree: "I would rather say that the two views are reconciled in the single universe envisaged by him." (87, f.n.) This reconciliation, or "synthesis of universal relativity," is one in which "the whole infinity of discrete and independent souls is yet fused into a vast Whole, transcending their discrete separateness, a Unity encompassing time and space, comprehended within infinite space and eternal time, a universal relativity within the immensity of the World Soul, governed by Mind. . . ." (91) Equivocation, rather than either oscillation or reconciliation, would seem the word most appropriate to designate Bruno's assertions about the divine nature, e.g., "the supreme Agent and supreme active power doth coincide in a single principle with the supreme potentiality, patient of all creation."

Although the "one infinite" of Bruno, like the God of St. Thomas, is perfect in being and immanent in spiritual efficacy, Bruno does not preserve transcendence of the divine substance. On the contrary he proclaims that ultimately matter is one with Act. This is pantheistic doctrine as is the contention that "the essence of the universe is one in the infinite and in every part or member thereof so that the whole and every part become One in substance." No judge faithful

to Thomistic philosophy could countenance such a "message." Moreover, Bruno had the imprudent courage of passionate conviction. His life exhibits the pathos of the crusader and visionary who believes that others cannot resist his truth if only they will open their eyes to it. With heroic and offending zeal he assailed the blindness of those who would not see the light when it was brought to them. Pathos became tragedy in a martyrdom which served to make the man's life memorable and to elicit interest in his thought. Bruno, like Socrates, had historical immortality conferred upon him by the tribunal which exacted his life in penalty for his philosophy. The ideas did not burn with the man. The very attempt at their suppression spurs historians to see in Bruno's life an exemplification of the humanistic spirit of free investigation and in his death a crime against that spirit. This is how Mrs. Singer envisages the life and thought of Bruno. The story she has to tell has perennial value but is timely indeed in this age when intolerance feeds on fear and proceeds to inquisitions.

Berkeley, California E. W. Strong

Jeremiah Finch. *Sir Thomas Browne. A Doctor's Life of Science and Faith.* New York, Henry Schuman, Inc., 1950. xi + 319 pp. $3.50.

The life of Sir Thomas Browne was on the surface an uneventful one. It was nevertheless an extraordinarily busy one. Not only was he a bustling family physician to the good people of Norwich, who recognized him as their leading citizen, but he was also a tireless scientist and scholar whose house and grounds soon accumulated a veritable museum display of zoological and botanical specimens. All kinds of birds and beasts, herbs and trees and flowers were under Browne's continuous scrutiny. The motive for such arduous labor was as much religious as it was scientific. Browne hoped to discover from these "hieroglyphics," as he called them, something of the nature of the Mind that created them. Browne's science and his faith were complementary to each other, not inimical, as they were to become so soon after his day.

Any study of Browne in our day almost automatically falls into a twofold division, i.e., it considers his science in relation to his religion or to his imagination. The first of these divisions is obviously easier to discuss. Dr. Finch's book provides us with a competent and much needed survey of Browne's life as a doctor—his medical studies at Oxford, Montpellier, Padua, and Leyden, his residence in Yorkshire, and his medical practice at Norwich. This survey Dr. Finch supplements with helpful discussions of the state of scientific learning at each of the schools which Browne attended. He also inquires into the nature of the scientific and antiquarian lore in Browne's works, especially the *Pseudodoxia Epidemica,* or *Vulgar Errors,* the *Urn Burial,* the *Garden of Cyrus,* and, of course, the famous *Religio Medici.* What Dr. Finch has to say of this whole

aspect of Browne's life, though little of it is new, does develop into a satisfying perspective on the immense scientific and scholarly background behind Browne's essential contribution.

This essential contribution lies of course in the profound religious evocations, the flashes of poetry and of wit, the tenderness and whimsey, the majestic draperies of the prose for which Browne's name is remembered, and which is the ultimate excuse for any book about him. This religious, imaginative aspect of Browne has stirred the pens of some of the most perceptive English critics, men like Coleridge, Lamb, Hazlitt, Walter Pater, Leslie Stephen, and Edmund Gosse. Before such an array any new author on Browne must pause and bow his head. Yet even with this large reservation, it must be said that Dr. Finch does the essential aspect of Browne less than justice. The subtitle of his book is "A Doctor's Life of Science and Faith." There is, however, very little in the book about faith or, perhaps more important, about what faith implies in a temperament such as Browne's. There is indeed some discussion of the *Religio* as "a doctor's confession of faith," but the central problem, hinted at by the subtitle, is not broached—the relationship between the science and the faith (even if "faith" be admitted as a term broad enough to include all the riches of Browne as a person). Dr. Finch's analysis of *The Garden of Cyrus* is a grand exception; here he indicates beautifully what may yet be achieved by a scholarly and critical analysis of Browne's prose. His investigation of the various versions of *The Garden of Cyrus* and his analysis of Browne's methods of composition are the most rewarding parts of his book.

New York, New York E. S. MERTON

H. M. SINCLAIR and A. H. T. ROBB-SMITH. *A Short History of Anatomical Teaching in Oxford*. Oxford, At the University Press, 1950. 81 pp., illus. 3/6.

THIS elegant little volume owes its origin to the Exhibition to Illustrate the History of the Teaching of Anatomy at Oxford which was held at the Radcliffe Science Library from February 20 to July 29, 1950. Drs. Sinclair and Robb-Smith, who participated in the preparation of the exhibition, felt that its memory should be perpetuated not alone by a catalogue of exhibits, but by a fuller account of the subject which the exhibits were intended to present.

The text of the book consists of an historical account of the teaching of anatomy at Oxford, plus four appendices containing a chronological table of anatomical teachers, the numbers of anatomy students in Oxford, a bibliography, and a catalogue of exhibits displayed at the Radcliffe Science Library. Finally, there is a series of twenty-one plates depicting not only objects listed in the exhibition catalogue, but also others of significance to the history of the subject but which could not be shown there.

Dr. Le Gros Clark, Professor of Anatomy at Oxford, contributes a preface

in which he suggests that this book offers a suggestion for the teaching of medical history to students. "For if the student," he says, "at the commencement of his studies, can be presented with the story of the development of his subject in his *own* University, with records of personalities and events which have immediate reference to the familiar environment in which he himself is actually working, he is likely to be imbued with the inspiration of history in a way which would not otherwise be possible. And he will then be tempted, of his own accord, to enlarge his field of historical knowledge by wider reading as his acquaintance with his subject grows." For any teacher interested in presenting the history of a specific medical subject this idea may well be worth pursuing.

This short history of anatomy at Oxford is well worth reading. The names of Harvey, Willis, Lower, Highmore, and many others occur in it. It is a proud record, and is brought to a close in 1935 with the election of W. E. Le Gros Clark as Dr. Lee's Professor of Anatomy.

Typographically, the book is well done. There is no index, but as if to make up for this, the price is phenomenally low. It is well within the reach of teachers and students.

GEORGE ROSEN

AXEL GARBOE. *Thomas Bartholin; et Bidrag til Dansk Natur- og Laegevidenskabs Historie i det 17de. Aarhundrede.* Vol. II. With an English summary. (Acta Historica Scientiarum Naturalium et Medicinalium, ed. Bibliotheca Universitatis Hauniensis, vol. VI) Copenhagen, Einar Munksgaard, 1950. 203 pp. Dan. kr. 21.

AFTER 1660, Thomas Bartholin relaxed his ardent activities. There still were many problems to be solved and observations to be made, but his work henceforth was centered on the recording of them rather than upon the exploring of new fields. His public anatomical demonstrations ceased, premonitions of impaired health arose, and in 1661 he allowed himself to be designated as Professor honorarius. *Centuria* V and VI of his *Historiarum anatomicarum et medicarum rariorum* was published in the same year. Eager to see the anatomical demonstrations continued, he caused young Jacob Henrik Paulli (son of Simon) to become his successor in this field. Bartholin meanwhile concentrated his efforts on a dispensatory (1658). Soon after, Denmark became involved in a war with Sweden (1658–1660). Then followed a period of polemics with Bils over the old problem of the lymphatics. Of great interest is his *Cista Medica* (1662) which contains valuable observations culled from his personal archives. The following year, his health growing increasingly indifferent, he retired with his family to a country estate not far from Copenhagen, and this became his home and the center of his activities during the next seventeen years.

In 1664 Stensen returned home and undertook demonstrations at the anatomical theater, as witnessed by his *De musculis et glandulis observ. spec.*, but the

constellation at the university was not indicative of a permanent post, even though Bartholin favored him, and Paulli still studied his profession in foreign lands. B., from his country home and his Copenhagen residence, busied himself with academic duties, a select practice, authorship, and the education of his children. He published his little treatise on domestic medication (1666), his *Epistolarum medicinalium centuriae* was continued, and from time to time, like many other naturalists, he turned his attention to casual subjects, such as the comet of 1664 and the broader recognition of national and popular tendencies of thought and habit. Like Haller and Osler in their days, Bartholin combined the naturalist's experiences with views derived from the humanities. He dealt politely with the fantastic Borri (1669), and in 1670 concentrated his efforts upon the very valuable collection of his fourteen papers, revised, published under the title *Vasa lactea et lymphatica*. During the same year, his beloved country home was destroyed by a fire and he lost many valuable manuscripts and anatomical drawings (enumerated in *De bibliothecae incendio*), but happily the material pertaining to the 1673 revision of his Anatomy was saved.

The home rebuilt, his work went on. It included a succession of university rectorates, an active membership in the supreme court, and from 1671 even the care of the university library, with countless other functions. Paulli, designated anatomy professor, had gone into clinical medicine, and Stensen was recalled from foreign parts, renewing the activities in the *domus anatomica* (1672–74). Thomas' son Caspar entered this field and found favor with the academic senate, which was obliged to look away from Stensen as a papist. Stensen left Denmark and never returned. Caspar, his brother Christoffer, and Holger Jacobaeus early in 1674 went abroad to pursue advanced studies, and Thomas turned his attention to the organization of medical practice in Denmark. His wife died in 1675. The widowed man, now definitely ailing, buried himself in work and published in 1677 Volumes III–IV of *Acta Medica;* the final one followed in 1680. In 1677 the promising sons returned home and Caspar entered upon his duties at the University. His father, sickening progressively with renal calculus, limited himself more and more to literary efforts and died December 4, 1680.

This descriptive biography, with its close analysis of Thomas Bartholin's work, will remain a classic among biographies. It supports, develops, and extends the critical bibliographical summary of the same subject by C. C. A. Gosch in 1873. An English translation of this biography should be made.

Elmhurst, Illinois J. CHRISTIAN BAY

PARACELSUS. *Selected Writings*. Edited with an introduction by Jolande Jacobi, translated by Norbert Guterman. Bollingen Series No. 28. New York, Pantheon Books, Inc., 1951. 346 pp., illus. $4.50.

THE Bollingen collection has added another beautiful volume to its monographs on religion and mythology. The 148 illustrations, happily integrated in the text,

give the reader a vivid picture of Renaissance man's outlook on life, nature, and God; the typographical work is impeccable, and Mr. Guterman has given a marvelously lively translation of Paracelsus' difficult language; occasionally he even succeeds in clearing up obscurities in the original. A glossary, a bibliography, and a key to sources increase the volume's usefulness. The material, consisting mostly of short passages from Paracelsus' works, is organized under the following headings: Credo, Man and the Created World, Man and His Body, Man and Works, Man and Ethics, Man and Spirit, Man and Fate, God the Eternal Light. Dr. Carl Jung rightly states in his endorsement of the book that its main emphasis lies on "the moral aspect of Paracelsus," and the selections are slanted to represent the famous iconoclast as a pious Christian. This anthology is not as outspokenly theosophical as its predecessor, the one Franz Hartmann published forty-three years ago, but it still is as "sectarian" (to use a Paracelsian term) as are most products of the Paracelsus cult. If the publishers intended to devote so much love and care to a volume on Paracelsus, why then did they not publish an English version of the anthologies by Kayser, Spunda, or Peuckert which give us the complete Paracelsus?

New York, New York HENRY M. PACHTER

GEORGE GASK. *Essays in the History of Medicine.* London, Butterworth & Co., Ltd., 1950. viii + 209 pp. 30/-.

FOR many years Professor Gask was a leading figure in British surgery and closely connected with St. Bartholomew's Hospital. On the occasion of his seventy-fifth birthday a number of his papers devoted to historical subjects were gathered together in the volume under review. As one might expect, these essays are concerned chiefly with the history of British surgery, particularly its military aspects. In addition, he was interested in the development of the medical schools of antiquity, and four papers deal with this topic.

Most interesting are the papers on the predecessors of Thomas Vicary, on the medical staff of King Edward III, and on the medical services of the army of Henry V in 1415. Of considerable interest also is the essay on John Hunter in the Portuguese Campaign of 1762–1763.

While many of these papers are based on archival material, it is clear that they are essentially occasional contributions by a busy surgeon. All of them are written *con amore* and in a pleasant style, but contain obvious gaps. For example, in the discussion of the care of the sick and wounded in Marlborough's campaign of 1704, Professor Gask describes the organization of the medical services, but does not indicate that this organization was instituted in the Cromwellian forces and survived in the post-Restoration army (C. H. Firth, *Cromwell's Army,* London, 1902, pp. 253–278). Similarly, in the paper on John Hunter there are references to the use of female nurses in military hospitals in

the time of William and Mary. The fact is that such nurses had been used much earlier in Britain, during the Civil Wars (cf. Firth, *op. cit.*, pp. 264–265). Also the medical military organization described is common to the armies of the later eighteenth century in Britain, Austria, Prussia, and so forth (for comparison see *Generalreglement oder Verhaltungen für die Kayserlich-Königliche Generalität,* Leipzig, 1784, pp. 276–287, 455 ff.)

In general, Gask speaks with the greatest authority in his own field of competence, surgery. Of this the three Lettsomian lectures on the history of treatment of wounds of the thorax bear witness. This volume of essays is a tribute to a leading surgeon and an inspiring teacher, and will certainly be of interest to a much wider range of readers than Professor Gask's broad circle of friends.

GEORGE ROSEN

C. FRH. VON PIRQUET and BELA SCHICK. *Serum Sickness.* Translated by Bela Schick. Baltimore, The Williams & Wilkins Company, 1951. xi + 130 pp. $3.50.

THE English-reading lovers of the medical sciences are indebted to Dr. Bela Schick for his "difficult and time-consuming" labor in translating the famous classic *Die Serumkrankheit*—"the foundation stone of the whole science of allergy."

In this work, originally published in 1905, von Pirquet and Schick announced a completely new concept of the causation of disease. Previously, antibodies had been known only as the protective mechanism of immunity to infective microörganisms and their poisonous products, the toxins. The investigations of these men revealed that some antibodies can perversely act as mechanisms of unpleasant and even dangerous susceptibility to an otherwise harmless substance—in their cases, horse serum. They stated the essential idea of the pathogenesis of a specific sensitivity reaction as follows: *"By interaction of antibodies and antigen, a toxic substance is formed."*

In retrospect the historically minded reader can enjoy the record of that announcement. Christopher Morley writes: "Nothing is more exciting . . . than to watch the world getting ready to think ideas quite different from those it is at the moment openly proclaiming." These words describe the medical-scientific atmosphere in which the fateful idea of von Pirquet and Schick was conceived.

Immunology was absorbing the experimental attention of leaders of research the world over. Richet and Arthus had reported their famous observations on "anaphylaxie" and the Arthus phenomenon without an inkling of their immunological significance; and two years earlier von Dungern (this reviewer's teacher) had published his work *The Antibodies,* upon which the theory of von Pirquet and Schick leaned heavily and which may even have suggested that theory.

The world was surely getting ready to think the new idea when it arrived, and scientists lost no time putting it to work. Ehrlich, then the high priest of immunology, did not miss the fundamental principle, and he set Otto to using it when he heard of the "Theobald Smith phenomenon"; and Wolff-Eisner, as early as 1906, saw its applicability in the explanation of hay fever. It was in hay fever that the theory of von Pirquet and Schick was first experimentally realized in a human allergic disease, a demonstration which came in 1925 with the recognition of the atopic reagins as the constantly occurring specific mechanism of that hereditary malady.

The recent discovery of a most serious allergic disease which is not mediated by humoral antibodies but by a mechanism bound up with the sympathetic nervous system, must also be credited to the influence of the teaching of von Pirquet and Schick. The tremendous importance of this newly recognized hereditary allergy will probably come very slowly to the full appreciation of the world. And as that understanding grows so also, in equal measure, must increase the world's sense of indebtedness to these two men.

It seems to be a "human" weakness to take satisfaction in the mistakes of others, especially those of one's eminent contemporaries. Yet we wish to see no flaws in the world's masterpieces, at least none of moment, and in this respect the classical work of von Pirquet and Schick pleases the student.

One pitfall that has since taken men of lesser genius was consciously avoided. The one antibody available for study at that time in the blood of the subjects of serum sickness was the precipitating antibody known as precipitin. After a masterly analysis of the evidence relating to precipitin as it occurs in serum sickness, the following conclusion was reached: "But the antibodies, which are responsible for the reaction, are not identical with precipitins." Those pioneers confidently declined the argument "Better one byrde in hand than ten in the wood," and were content to postulate an unknown antibody rather than tie their theory to the known one which did not fit the facts. Their wisdom had to wait thirty-eight years for its final unequivocal confirmation in the reports of Samuel Karelitz from the Willard Parker Hospital. With the procedure of reverse passive sensitization Karelitz identified the antibody of serum-sickness as distinct from both precipitin and the atopic reagin.

Oradell, New Jersey ARTHUR F. COCA

LOUIS H. RODDIS. *James Lind, Founder of Nautical Medicine.* New York, Henry Schuman, 1950. xi + 177 pp., illus. $3.00.

THERE is real fascination for most of us in stories of the sea and sailing ships, long before steam had been introduced as motor power. Those were the days of hardy, tough seafaring men, who battled both the elements and foreign foes with some chance of survival, and yet countless of them weakened and succumbed to the most deadly enemy of all, disease. This spector stalked silently

among the crews of ships at sea taking a toll in life far larger than did storm or warfare, and there seemed no way to save them. At long last, however, this scourge came under control and was conquered. We are more or less familiar with the manner in which the dangers at sea from the elements or from warfare were lessened, but many have never heard the dramatic tale of how disease on shipboard was conquered by sea surgeons of the eighteenth century. Here in this small volume we are given a very complete and readable story of the beginning of the scientific approach to modern nautical medicine.

Captain Roddis has built a graphic story around the biographical facts in the life of a young naval surgeon of the first half of the eighteenth century—for he was only twenty-three years old when certified by the Barber-Surgeons Company of London for duty in the Navy. I am certain that James Lind must have found life aboard His Majesty's ship *Centurion* most irksome and unbearable, since his only duty was to care for the sick or injured, while in every part of the ship he saw signs of neglect of the health and well-being of the crew, about which he was not supposed to concern himself at all. The sailors lived in cramped quarters between decks, and during storms with hatches battened down they nearly suffocated in the damp, foul, and vitiated atmosphere. The food was of very poor quality and variety, was insufficient in essential vitamins, and soon became infested with maggots. The drinking water, small in quantity, became stale and unpalatable in the casks which contained it, and was contaminated only too often with the germs of some intestinal disease. Newly recruited members of the crew introduced contagion and brought body lice carrying jail fever to the ship, which added to the discomfort and ill health of their companions. Added to the unhealthy surroundings was the harsh treatment meted out to the sailor in the form of cruel punishments, often for some slight offence. James Lind investigated all of this and scientifically worked out reforms to counteract these faulty conditions, which he later published in two important communications, *A Treatise on Scurvy* (1753) and *An Essay on the Most Effectual Means of Preserving the Health of Seamen in the Royal Navy* (1757). This brought a much neglected subject to public notice and it was not long before Lind's advice was adopted by the Royal Navy and henceforth the naval surgeon was given the added duty of supervising the sanitation and hygiene aboard ship and was held responsible for preserving the health of the crew.

The account of the conquest of scurvy—its prevention and treatment—a dramatic tale, covers half the volume. This disease was accountable for the death of "four or even five thousand" sailors of the Royal Navy each year. On reviewing the literature upon the subject, "the dread Scourge of the sea," Lind discovered that John Woodall, Surgeon to the East India Company, had written as early as 1639 recommending the use of citrus fruit in both treatment and prevention of this deficiency disease, and that others had confirmed his findings,

but that practical use had not been made of this important knowledge and thousands upon thousands of persons had died from scurvy since that time. This appears to have acted as a challenge to James Lind who set out at once to investigate the matter. This he did through the use of clinical research, taking several groups of individuals suffering from the disease and feeding each group with a different diet. His conclusions were definite; he became convinced that the feeding of fresh vegetables and especially citrus fruit was a cure and an absolute preventive for the disease. This and other reforms in nautical sanitation were put to practical test between the years of 1772 and 1775 by Captain James Cook during his second voyage to the Pacific. The honor of the conquest of scurvy belongs to James Lind, although others had earlier discovered the efficiency of oranges and lemons in its cure, since he made himself heard and obtained action in the Navy whereby his views were accepted. *A Treatise on Scurvy* has become in consequence one of the most important classics in medicine.

Lind accomplished much more than his victory over scurvy since his writings, full of sound reasoning, tell of the method for ventilating ships, of the manner of procuring fresh palatable water by the distillation of sea water, of the manner of preserving foods, the procedure for use in the resuscitation of the apparently drowned, the prevention of communicable diseases by isolating recruits before placing them on shipboard, his use of cinchona bark for treatment of intermittent fever, his knowledge of tropical diseases, and many more subjects of lesser importance.

Ten years after his retirement from active duty at sea, while practising in Edinburgh, Lind was appointed Physician to the large Royal Navy Hospital at Haslar, where he served with distinction for twenty-five years.

The well-written text of this interesting and instructive biography is aptly illustrated with reproductions of contemporary prints. It is to be regretted that a few minor errors escaped the eyes of the proof reader.

This small volume can be most heartily recommended to the discriminating reader who wishes an interesting and authentic account of the further conquest of the dangers of the sea by men other than mariners; a book written by an author who is well known for his knowledge of the history of nautical medicine.

New York, New York FENWICK BEEKMAN

ROBERT G. PATERSON. *Foundations of Community Health Education*. New York, McGraw-Hill Book Company, Inc., 1950. xix + 288 pp., illus. $3.75.

THE value of the historical approach in presenting to the student a proper perspective on the subject which he is studying has been amply demonstrated. We cannot fully grasp all the implications of our present knowledge nor can its

constituent elements be properly assessed, unless there is some appreciation of its genesis. It was with this general purpose in mind that Dr. Paterson prepared this volume as an over-all orientation for students of public health, health and physical education, and community organization. The book is divided into two parts, of which the first deals with the broad background of medical knowledge and social development, while the second is more specifically concerned with modern public health.

There is no doubt that the author's intentions are laudable, or that he has labored industriously to achieve them. Despite this, however, the final result falls far short of the aim. For one thing, the book is marred by numerous historical errors and distortions of historical perspective. It would only bore the reader to list them all, but a few illustrations will suffice to make the point.

On page 47 the statement occurs that "the Dark or Middle Ages are the titles given to the years covering the fifth to the eleventh century (A.D. 476–1000). All that Hippocrates and his followers had gleaned from an impassive nature, all that Galen had added to his store of information, was shrouded from view throughout this gloomy period." These two statements, I submit, are incorrect. First, the Middle Ages is a term used to cover the period between the institution of the Christian Roman Empire in the fourth century and the Renaissance. Secondly, there is no justification at all for saying that Hippocrates and Galen were unknown during this period.

On page 48 we are told of the "struggle between the masses and classes which began with Magna Carta." This too is an inaccuracy. Magna Carta emerged from a struggle between King John and the feudal barons, who were fighting against a centralization of royal power, and it did not lay any of the groundwork for the Renaissance, as is implied in the paragraph from which the statement is taken, nor were the masses involved. On page 54 there is reference to Bacon's *Novum Organum* (*New Atlantis*). If the author means that these are identical, this is incorrect. They are two separate works; the *Novum Organum* appeared in 1620, the *New Atlantis* in 1625. John Graunt did not construct the first London Life Table as is stated on page 58. This was the achievement of Edmund Halley, the mathematician and astronomer. The improvement of the condition of the mentally ill was not started by Pinel in 1801, but in 1793. It was in 1801 that he published the first edition of his *Traité Medico-philosophique sur la Manie,* based on his experiences at the Bicêtre Hospital (see page 64). On page 96 we are told that Johann Peter Frank published his *Medicinische Polizey* in four volumes between 1777 and 1788. This is also incorrect. Frank's first volume appeared in 1779. During his lifetime six volumes were published. In addition three posthumous volumes were issued, the last in 1827. Furthermore, Max von Pettenkofer was a follower of Frank only in a chronological sense. A statement of this kind distorts the historical situation.

The English Reform Bill of 1832 did not have "as one of its objectives that the government should take over responsibility for the betterment of social conditions." It was the result of a struggle of the English middle class to obtain the franchise and to oust the upper classes from power. Similarly the Poor Law Amendment Act of 1834 was not immediately concerned with public health, but rather in getting rid of the Speenhamland system and other means of protecting rural workers, so that these would be added to the labor force needed for the factories. The public health aspects of these laws were indirect products that came later.

A similarly distorted impression is given on page 104 with regard to the Births and Deaths Registration Act. This was really a by-product of the factory legislation of 1833. It was the need for establishing the age of children for factory work which led Chadwick to prevail on Lord Lyndhurst to introduce into the House of Lords a measure to provide for the appointment of a Registrar-General and the establishment of a General Registry Office.

On page 130 we are told that "In 1900 Sigmund Freud (1856–1939), a young Austrian physician specializing in neurology published his work 'Studies in Hysteria.'" This too is incorrect. The volume *Studien über Hysterie* was published in 1895 and was the joint work of Freud and Breuer. Nor did psychoanalysis make it possible to "see" inside the human mind. This type of statement is quite meaningless.

There are many other specific items that might be cited, but enough evidence has been presented to show that the author has not fulfilled a basic obligation, namely, the presentation of accurate information. The responsibility of a teacher for presenting accurate and undistorted information to students is as great as that of a physician in prescribing treatment for a patient. The entire text should have been subjected to more rigorous scrutiny before publication. Perhaps these defects can be remedied in a second edition.

There is an index, and bibliographical references are given for further study.

GEORGE ROSEN

J. MENZIES CAMPBELL, Comp. *A Dental Bibliography, British and American, 1682–1880. With an Index of Authors.* London, David Low (Publishers) Ltd., 1949. 63 pp.

THE volume under review is a bibliography of British and American dental books and pamphlets printed between 1682 and 1880 compiled by Dr. J. M. Campbell, a Glasgow dentist, who is known as a dental historian as well as a collector of early books, advertisements, and other materials relating to dentistry. The compilation is based on the bibliographical works of S. S. Fitch (1829), J. C. F. Maury (1833), P. B. Goddard (1844), R. Arthur (1851), J. E. Dexter (1876), J. O.

Coles (1883), C. G. Crowley (1885), and B. W. Weinberger, as well as on the catalogues of the large libraries of booksellers and publishers.

As far as one may judge from spot sampling, Campbell's bibliography, arranged chronologically and followed by a name index, is highly accurate. It comprises 417 dental books and pamphlets published in Great Britain and Ireland from 1682 to 1880, and 306 items published in the United States between 1801 and 1880. The year 1682, given on the title-page as the beginning of English dental literature, may at first glance create some confusion since the bibliography starts with the year 1685. The bibliographically important first publication to which the year 1682 refers is given by Campbell on the last page of the bibliography under the heading "Addenda," without any explanation in the preface. This may be due to the fact that this first dental work in English (*A Treatise of Cleanness in Meats and Drinks, of the Preparation of Food, the Excellency of Good Airs, and the Benefits of Clean Sweet Beds. Also of the Generation of Bugs, and their Cure. To which is added, A short Discourse of the Pain in the Teeth, Shewing from what cause it does chiefly proceed, and also how to prevent it,* by Tho. Tryon. London, 1682) was first brought to light by the English dentist R. A. Cohen while Campbell's bibliography was in press (*Brit. Dent. J.* 1949, *86*, 41), and was then included in it. Until then *The Operator for the Teeth* by Charles Allen (York, 1685) was considered the first dental work in English, but this distinction must now fall at least bibliographically to Tryon. In this sense Campbell's choice of 1682 as his initial date is justified. It is not clear, however, why he chose 1880 as the terminal date.

The value of Campbell's bibliography, which is an extraordinarily useful reference work for dental schools, libraries, booksellers, and collectors, would have been enhanced if the full title and number of pages of each work were indicated, and furthermore if the compiler had designated those works which had been translated into English from foreign languages.

New York, New York CURT PROSKAUER

THE WELLCOME HISTORICAL MEDICAL MUSEUM. *Catalogue of an Exhibition Illustrating Medicine in 1850.* London, New York, Oxford University Press, 1950. 64 pp., illus. 60¢.

THIS *Catalogue* lists the books, periodical articles, portraits, illustrations, instruments, and anatomical preparations displayed in an exhibition opened in May 1950. The exhibition described the progress of medicine throughout the middle of the nineteenth century and must have done so very handsomely. Such exhibitions always have their weak spots generated by gaps in the holdings of the institution and in the lack of suitable exhibition space. For instance anaesthesia was portrayed by two pictures, but none of the early literature on the subject is listed. However, the most startling gap is the absence of surgery although there are sec-

tions on "Physics," "Chemistry," "Public Health," and "Hospitals and Nursing." The *Catalogue* is not sufficiently complete to be considered as a bibliography, but it does describe adequately the major advances that were made shortly before and after 1850.

New Haven, Connecticut FREDERICK G. KILGOUR

EDV. GOTFREDSEN. *Medicinens Historie.* Kjøbenhavn, Nyt Nordisk Forlag Arnold Busck, 1950. vi + 514 pp., illus.

WITHIN the past few years, a number of general histories of medicine have appeared in Europe, Great Britain, and the United States (mention may be made of Pazzini, Diepgen, Guthrie, and Mettler). To these may now be added the volume by Dr. Gotfredsen of the Medico-Historical Museum at the University of Copenhagen. Based upon lectures given to medical students at the University since 1941, this history is intended for physicians, medical students, and other medical personnel, but the author feels that it may also be of value to students of cultural history.

In organization and presentation, Gotfredsen's volume is traditional. The author follows the well-trodden path of his predecessors. Within the first forty-odd pages there pass in review prehistoric and primitive medicine, the medicine of Mesopotamia, Egypt, China, Japan, India, Tibet, Iran, the Jews, Mexico, and Peru. Then follow sections on Greek and Roman medicine, the medicine of the Middle Ages, and the Renaissance. The remainder of the volume is then divided by centuries, from the seventeenth into the twentieth.

However, the arrangement and presentation of the materials within these sections is only mediocre. In general, there is too much emphasis on the presentation of isolated facts, and not enough attention paid to their integration and interpretation. As a result the picture offered the reader is confused and unclear. Take, for example, the relation between Pinel and Bichat. Pinel is mentioned among the vitalists as a pupil of Barthez (p. 240), and it is pointed out that by adopting Condillac's sensualistic empiricism he paved the way for Bichat's tissue doctrine. This is followed by a discussion of J. C. Reil and J. F. Blumenbach and their vitalistic doctrines. Only on the next page does the author return to Bichat. Other instances of inadequate integration of data can be cited. Furthermore, the closer the author approaches the present, the more does his text become a listing of names and dates.

Summing up, this is an adequate traditional history of medicine which offers little new. It is of interest as illustrating the content of the lectures given by Dr. Gotfredsen, and calling attention to outstanding Scandinavian personalities in medicine. Otherwise it offers little to American or British readers.

There is an index and an extensive listing of relevant literature.

GEORGE ROSEN

FRANCESCO CORDASCO. *A Bibliography of Robert Watt, M.D., Author of the Bibliotheca Britannica,* with a Facsimile Edition of His *Catalogue of Medical Books* and with a Preliminary Essay on His Works . . . New York, Wm. F. Kelleher, 1950. port. 27 + 72 pp. $10.00.

IN his preface Dr. Cordasco writes that he has long lamented that Robert Watt (1774–1819) was so little known and respected. To the medical profession as a whole no doubt he is unfamiliar, but to those engaged in historical or literary research, the name of Robert Watt enjoys that immortality reserved for the bibliographer, as his *Bibliotheca Britannica* . . . London, 1824, is even today a vast store of information. Details of his life and his other work are not so well remembered. During the years 1811 to 1816 Watt taught the practice of medicine at Glasgow. In 1812 he published his *Catalogue of Medical Books, for the Use of Students attending Lectures on the Principles and Practice of Medicine; with an Address to Medical Students, on the Best Method of Prosecuting their Studies.* His library of over a thousand volumes was made available to his students who did not have access to any large medical collection such as those which are found today in medical schools. The list of books shows a well-rounded selection of authors past and contemporary, such as Hippocrates, Dioscorides, Celsus, Galen, Paré, Eustachius, Fabricius, Caesalpinus, van Helmont, Bartholinus, Boerhaave, Abernethy, Alibert, Arbuthnot, Astruc, Baillie, Cullen, Currie, Fothergill, Heister, Hunter, Monro, Priestley, Ramazzini, Spallanzani. English medical journals were well represented, but not foreign scientific periodicals. A note at the end informs the student that the subscribers (the fee was five shillings) would have access also to "above one thousand theses." The library was open only one hour a week, and students could borrow but two volumes for a period of two weeks.

This catalogue with the address to medical students is of value to anyone interested in the development of medical education. Dr. Cordasco's reason for publishing the facsimile is the great rarity of the original. He writes, "I determined to procure a copy. Little did I realise that my determination would entail enquiry at most of the great libraries of the world, and that for many years I was to remain disappointed. My ultimate success amply repays my labour." The reader would assume that Dr. Cordasco now owns a copy from which the facsimile was made, but he neglects to say so. Nor does he locate copies elsewhere, unless a clue is furnished by his dedication to "Dr. Archibald Goodall, the Royal Faculty of Physicians and Surgeons, Glasgow, who made this work possible." It would have been of interest and service for him to have told something of the results of his intensive search.

The *Catalogue,* too, should have been emphasized in the title, rather than the bibliography which occupies only four pages. It includes a list of the writings of Watt, printed and in manuscript, as well as "biographical and critical notices." The latter cites some twenty references to Watt and his work, mentions where portraits may be found, and names the two libraries which own parts of the

manuscript of the *Bibliotheca Britannica*. Dr. Cordasco's introduction, a well-documented account of Watt and his writings, should introduce to a wider public this bibliographer, physician, and medical teacher. Unfortunately, only 250 copies were printed.

New York, New York GERTRUDE L. ANNAN

TOMÁS ROMAY. *Apuntes Biograficos y Discursos*. Recopilacion y prologo de Jose Lopez Sanchez. (Cuadernos de Cultura, Octava Serie, 6) La Habana, Publicaciones del Ministerio de Educacion, 1950. 316 pp.

FIRST in a long line of outstanding Cuban physicians is undoubtedly Tomás Romay (1769–1849). In many ways he embodies the spirit of the eighteenth century and the Enlightenment. Romay was widely known as a writer and lecturer, and he had an intense interest in many areas not immediately related to his professional concerns. In medicine, it may be recalled that in 1804 Romay introduced smallpox vaccination into Cuba and to demonstrate his faith in this procedure inoculated his own children. Romay was also a close student of yellow fever and other communicable diseases. In 1797, he published an essay on yellow fever which ranks with the best writings of the period on this subject.

Dr. Lopez Sanchez has collected materials by and about Tomás Romay and has presented them in this handy volume. A brief essay on Romay by Anselmo Suarez Romero is followed by a section on Romay's activities in the Sociedad Economica de Amigos del Pais from 1793 to 1849. This section illustrates the breadth of his interests, ranging as they did from botanical gardens, the organization of an anatomical museum and demography to Cuban flora, hydrology, and vaccination. Romay's essay on yellow fever follows this section. This as well as his memoirs on the introduction and progress of vaccination in Cuba (1805) are the high spots of this volume from the point of medical history. Dr. Lopez Sanchez has made a valuable contribution to our knowledge and understanding of the development of medicine in Cuba. In the light of this publication we look forward to his forthcoming biography of Tomás Romay.

GEORGE ROSEN

EDGAR BONJOUR. *Theodor Kocher*. (Berner Heimatbücher, No. 40/41) Berne, Switzerland, Paul Haupt, 1950. 61 pp., 22 pl. Sw. frs. 7.00.

THIS book, written by a member of the Kocher family (the author, a professor of history at Basle University, is married to a granddaughter of Theodor Kocher), presents a brief résumé of the life of this great surgeon. Its charm lies in the fact that more than most other biographies it stresses the human side of Kocher's life and shows the devotion and love with which his memory is preserved and kept alive by the members of his family.

The curriculum of Kocher's life was comparatively simple. He was born in Berne, the capital of Switzerland, and spent his whole professional career, from student days through interneship to professor of surgery and director of the Inselspital, in that city. Though calls to other, more prominent and larger universities (for instance Vienna and Berlin) came to him, he refused to leave his homeland. From early childhood he showed a strong religious feeling and was a deeply religious man through his whole life.

Kocher had the good fortune to reach the highly coveted position of *Ordinarius* at the early age of thirty-one and he remained in that position for forty-five years. Thus he was able to build up an organization which was quite unique. His clinic could truly be called a mecca, for it attracted surgeons from all over the world. One of his students was Harvey Cushing, who later acquired an international reputation as the leading brain surgeon of the world. It may be of interest to recall the following episode which is recorded in Fulton's life of Cushing. When Cushing asked Kocher to give him a research project, Kocher gave him not merely the title "Compression of the Brain," but outlined every step of the project. This little incident shows that Kocher was not only one of the recognized leaders in the clinical and operative surgery of his day, but was able to plan every detail of a research problem.

The present practice of calling specialists in other fields into consultation in an attempt to establish a diagnosis was unknown to Kocher. He seemed to master every field of medicine and he made his own neurological and ophthalmoscopic examinations and diagnoses.

It is well known that Kocher was the great master in the surgical treatment of goiter. People from all over the world came to him for relief. He reduced thyroid mortality from 18% to ½ of 1%, a great accomplishment in those days. However, he left his imprint in many other fields of surgery. His method for reduction of a dislocated shoulder is still used today. Among operations which bear the name of Kocher are a new method for gastric resection and for the repair of inguinal hernia.

He was an excellent teacher. The best proof for this statement is his great work *Chirurgische Operationslehre,* one of the outstanding books on this subject. It is unsurpassed to this day in clarity of presentation.

Great and well-deserved honors came to him from different parts of the world. To mention only a few: he was made Rector of his alma mater at the early age of thirty-seven. In 1905 he was elected President of the first International Surgical Congress in Brussels. The crowning honor—in fact the greatest that can come to any member of the medical profession—came to him in 1909 when he was awarded the Nobel prize not only for his great surgical skill in the surgery of the thyroid gland, but for his masterful studies of its physiology and pathology. While some surgical specialists (Carrel in 1912 in experimental surgery and Baranyi in 1914 in otology) have received identical honors, no other general surgeon has been found worthy of this great prize during the last forty years.

In spite of his arduous duties as surgeon and teacher, Kocher found time to publish about 150 papers on a great variety of subjects. Naturally diseases of the thyroid gland represented a large proportion of these. However, a list of his publications shows that Kocher, unlike present-day surgeons who usually specialize in a rather narrow field (either brain, chest, abdomen, or extremities), was in the true sense of the word a "general" surgeon. His publications included orthopaedic subjects as well as abdominal, gynecological, neurological, and even military surgery.

Professor Bonjour's book was evidently written mainly for lay readers. As such it should fulfill its purpose splendidly, as it has a clarity of style which makes for easy reading and contains sufficient reference to the work of the great teacher and surgeon to absorb the interest of the public.

This little book brings back to life a great personality and a leader in his chosen profession—truly a Titan among surgeons. His memory will live for many years to come.

New York, New York RICHARD LEWISOHN

DONALD C. DORIAN. *The English Diodatis.* New Brunswick, N. J., Rutgers University Press, 1950. xvii + 365 pp. $5.00.

THIS book will appeal primarily to students of sixteenth and seventeenth century English literature and society; it offers relatively little to medical historians. Mr. Dorian's account of the wanderings of a substantial Italian Protestant family from Lucca to Switzerland and France and on to England and of its absorption of differing cultures throws into relief the elements in the peopling of England. His stress on the relations of Charles Diodati with John Milton will attract persons occupied with literary genealogy just as his tracing of family connections will interest the garden variety of arborist. Although the Diodatis included physicians among their numbers, their training and ideas, to which the author gives some good pages, were in no wise remarkable. Mr. Dorian's enthusiasm—often quite infectious—has occasionally led him to verbosity, but at that the text comprises barely more than half the total, the remainder being given over to elaborate notes, appendices, a full bibliography, and an index.

Columbia, Missouri CHARLES F. MULLETT

HANS FISCHER. *Goethe's Naturwissenschaft.* Zürich, Artemis Verlag, 1950. 91 pp. S. frs. 4.20.

IN this small book, Professor Fischer offers one of the best short accounts of Goethe's researches in natural science. The author strives to present Goethe's views as clearly as possible and to interpret them in the most adequate manner. As a result, the presentation is neither critical nor apologetic, but imbued with a

desire to render the material as understandable as can be. In other hands, perhaps, such an approach might have produced simply a listing of Goethe's scientific investigations and a recapitulation of his views on specific subjects. Fischer relates this information to Goethe's general approach to nature and science, to the state of scientific research at the time, and in general to his personality.

Fischer discusses in turn Goethe's studies in physiognomy, biological morphology, metamorphosis of plants, comparative anatomy, geology and mineralogy, chemistry, and color theory. It becomes abundantly clear that Goethe was no analytical scientist. In considerable measure, he was a Romantic scientist. This becomes evident in his concern with the ideal type, but equally so in his endeavor to gain insight into the dynamic formative principle of nature.

This book is recommended as a brief, yet comprehensive, presentation. It is well supplied with explanatory notes, but there is no index.

GEORGE ROSEN

RAFAEL SCHIAFFINO. *Los Cirujanos de Artigas.* Apartado del Boletin Histórico del Estado Mayor General del Ejercito. Montevideo, Uruguay, 1950. 133 pp.

THIS small volume provides brief descriptions of the accomplishments of a group of surgeons serving under, or otherwise related to the Uruguayan patriot, General José Artigas. It is well documented by personal letters and copies of official records. Readers will find in it an interesting and valuable account of the state of medicine in Montevideo and Buenos Aires at the opening of the century, during the liberation from Spanish rule. References to vaccination and military medicine are of particular significance.

Philadelphia, Pennsylvania ESMOND R. LONG

ABU BAKR MUHAMMAD IBN ZAKARIYA (*Rhazes*). *Tratado de la viruela y el Sarampion.* Traducción, notas y comentarios por el Dr. Anibal Ruiz Moreno. ANIBAL RUIZ MORENO, VICENTE RISOLIA and ROMULO D'ONOFRIO. *La Sanidad Militar en la Guerra del Brasil.* (Publicaciones del Instituto de Historia de la Medicina, Volumen XII, Tomo II) Buenos Aires, 1948. 153 pp.

THIS volume contains two very different historical works. The first is a Spanish translation of Rhazes' treatise on smallpox and measles. The translation by Dr. Moreno was made not from the Arabic text, but from Greenhill's English version. There are two introductory chapters on the life and work of Rhazes, and these are followed by the text itself.

The second item is an essay on military medicine in the war of Argentina against Brazil which culminated in the battle of Ituzaingó (February 20, 1827). An appendix presents the documents on which the paper is based.

GEORGE ROSEN

Bibliographia Medica Helvetica, 1943–1947, Vols. 1–5. Basel, Benno Schwabe & Co., 1944–1948. Fr. 15 pr. volume.

SINCE 1944 an annual volume listing the Swiss medical literature has been appearing. Entitled *Bibliographia Medica Helvetica,* five volumes dealing with the years 1943–1947 have been published so far. Each of these contains a section on the history of medicine which will be of interest to readers of the Journal.

GEORGE ROSEN

GULIELMA FELL ALSOP. *History of the Woman's Medical College, Philadelphia, Pennsylvania, 1850–1950.* Philadelphia, J. B. Lippincott Co., 1950. xii + 256 pp. $4.00.

THE author's allegiance to the subject and characters of her story is both obvious and understandable. Being a member of the class of 1908 of Woman's Medical College, Gulielma Fell Alsop writes feelingly of the origin and history of the only surviving "female medical college" of several which arose during the last half of the nineteenth century. From these citadels of feminism sallied forth the skirted physicians and surgeons of the Victorian generation, living documentation for the cause of Susan B. Anthony, Catherine Bloomer, and Lucy Stone.

Elizabeth Blackwell spearheaded the movement to secure recognition for women in medicine by becoming at Geneva Medical College in 1849 the first woman medical graduate in America. The cause for women in medicine too frequently and perhaps unfortunately was supported by male physicians who had become identified with sectarian medicine. Nevertheless, they rendered a service to the fledgling movement at a time when smug regulars ridiculed efforts to establish medical schools dedicated to the education of women. The cause was also vigorously sustained by such crusaders as Samuel Gregory of Boston, who was obsessed with the idea that female patients—obstetrical cases in particular—should have the attendance of women physicians and thus be spared the exposure to morbid-minded males, who, Gregory implied, were flocking into the study and practice of medicine.

It appears that Woman's Medical College was spared espousal by such zealots, although among its first promoters and teachers were a few men whose therapeutic beliefs were not orthodox and who, for the good of the College, were eventually eliminated from the inner circle. From the viewpoint of a century later, it seems rather clear that the greatest strength of the beginning institution in the 1850's was the consistently strong and meaningful support provided by liberty-loving Quakers, both physicians and laymen.

After Elizabeth Blackwell's first year at Geneva and her following summer (1848) as a nurse on the typhus wards at Blockley, an attractive and mature (born in 1813) Quaker maiden, Ann Preston, was inspired to make the rounds of Phila-

delphia's medical schools, seeking admission. She was denied; but already men and women of conviction were entertaining the idea of founding a medical school for women. The embryonic thought was maturing in the mind of one William J. Mullen, a philanthropist and student of science who believed that woman's entrance into the sphere of medicine would be the harbinger of increased health and happiness for women and for the race.

The legislature at Harrisburg granted a charter of incorporation to the Female Medical College of Pennsylvania under date of March 11, 1850. There was one opposing vote, that of a physician from Philadelphia. When the opening lecture was delivered on October 12, 1850, there were two clergymen on the platform, said to be the only Philadelphia gentlemen of the cloth willing to risk their identity with the novel, and in some quarters much maligned, undertaking. William J. Mullen was President of the "Corporators" and James F. X. M'Closkey, M.D., was Dean of the faculty. Even the name of the janitor, Mr. Henry Birnbaum, rated mention at the bottom of the faculty page in the "First Annual Announcement . . ." and on the final page it was noted that he would always be in attendance "to receive the commands of pupils."

Elizabeth Blackwell declined the chair of surgery. Hence the first faculty was of necessity made up entirely of males. It took time to establish a female dynasty. Since the M.D. degree was granted after two brief winter terms of study, the conventional medical course of the time, the College graduated its first class of eight young women on December 30, 1851. The Quaker doctors who piloted them through their course were quite as elated as were their pupils. Male medical students in Philadelphia vowed they would not permit women to receive the degree, but the impressive commencement exercises were uninterrupted.

In two and a half years Ann Preston, a member of the first class, accepted the chair of physiology, thus becoming the first woman to occupy a professorial chair in an American medical school. Mature in years, and seasoned in intellectual insight, Ann Preston was a "natural" for this appointment. Her graduation thesis, which in forthright manner outlined the basic principles of psychosomatic medicine, should be read by all young physicians today and perhaps by some older practitioners who think that the current emphasis on the patient as a physical and mental entity is a modern contribution.

From this time onward, Woman's Medical College came more and more to be the lengthening shadow of its patroness saint, Ann Preston, and of her equally devout lineal descendants. She became dean in 1866 and within a few years secured clinical privileges for her students at both Blockley and Pennsylvania Hospital. Her crusading students conducted themselves as professional ladies on mixed ward walks in spite of the fact that "gentlemen" students spat tobacco amber upon their frocks. The portrait of this comely prophet of science, medicine, and the emancipation of her sex today graces the wall in the dean's office and her quiet gaze elevates and ennobles the desires and ambitions of twentieth century daughters of the healing art.

Dean Preston has been followed by five deans: Rachel Bodley (1874–1888), Clara Marshall (1888–1917), Martha Tracy (1917–1940), Margaret Craighill (1941–1946), and Marion Fay since 1946. Their periods of administration complete the first one hundred years of existence of this unique college. Its history has been marked with conflicts, struggles for existence, and some achievements. The contribution of the College to the advancement of foreign medical missions through the dedicated lives of some of its alumnae is both inspiring and of historical importance. Author Alsop traces the ebb and flow of the College's fortunes with objectivity, but at times resorts to a noble finesse in the handling of internal disagreements and top level professional conflicts.

This well-documented volume is a valuable contribution to the social history of the United States. It sheds light on Woman's Medical College as a product of the nineteenth century woman's rights movement and likewise as a powerful influence in bringing the parent movement to fruition in the twentieth century. Woman's Medical College today has its legitimate place within the context of social acceptance, educational accomplishment, and professional fellowship.

Chicago, Illinois WILLIAM FREDERICK NORWOOD

OSLER, SIR WILLIAM. *Aphorisms from his Bedside Teachings and Writings.* Collected by Robert Bennett Bean, edited by William Bennett Bean. New York, Henry Schuman, Inc., 1950. 159 pp. $2.50.

THE shadows lengthen and the once familiar figure of Osler recedes into the embracing umbrage of history. Seemingly he died but a short while ago, but so greatly has the world changed in its spiritual and material aspects, so altered are our means and our values, that by the gauge of contrasts he appears to have had his being and to have had his sway in a totally different world—in a remote generation. That unbounded faith in the permanence and stability of human institutions and in man's ultimate devotion to the good, the true, and the beautiful, which shores and buttresses all that Osler avowed, is somewhat alien to our own temper, and against the remembrance of our late experiences and our current travails it has the semblance of a vapid naiveté.

But the fault is surely not in Osler. It is rather we who are at fault, and those values which Osler affirmed are not abased because *we* do not prize them. Truth has its unique validity, unaffected by the multitude's affirmation or denial. And truth, the good, and the beautiful endure, or else what were the struggle worth?

It was some such faith that inspired Dr. Robert Bennett Bean to collect, and his son Dr. William Bennett Bean to issue, the *Aphorisms* of Osler. In the Introduction, the younger Bean writes:

> . . . the mood of contemporary man is compact of tender spots, paresthesias, and anesthetic regions. A seeming hardness of heart has beset him and, alerted for evil, he is on the defensive. But we all may have profit by pausing from our too exclusive focus on the objective, the technical, and the scientific to renew and refresh our thoughts by recalling through his words the spirit of medicine's great humanist, William Osler.

The anthology is the proverbial easy mark for the carping critic. It were as easy as it were fatuous to find fault with this or that among the aphorisms selected; to take issue with John Fulton, who contributed the Foreword, as to whether it *has* been said, or said correctly, that Osler "exerted a wider influence upon the medical profession than any other man of his time," and to be otherwise testy. It were all beside the mark! This small work must be taken as a whole, as a labor of love and of devotion. It is one man's enthusiasm, from which others may take their spark. It is a distillation suited for the young to sample, and thereby to be drawn to the fount. It is a compendium which the informed will use to revive the memory of other passages, other gems.

In other respects, too, it is a handsome volume, and its publisher Henry Schuman deserves commendation. The format is just what it should be, small and of excellent proportions. The type and page are most pleasing. The Table of Contents serves also as an index. There is appended a good bibliography, whereby the interested reader might pursue further the matters aphoristically presented. The dust jacket carries a portrait of Osler: one or more of Osler, at different stages of his life, would have been welcome inside the work. The Introduction proper is of and by itself a perfect gem.

New York, New York IAGO GALDSTON

NOTES ON CONTRIBUTORS

FENWICK BEEKMAN, M.D., Consulting surgeon of Bellevue Hospital, New York, and President of the New York Historical Society, is well known to medical historians for his long-continued interest in the Hunters.

EBBE C. HOFF, M.D., is Associate Professor in charge of the section of Neurological Science, Medical College of Virginia, Richmond.

ALEXANDER LENARD, formerly Chief Anthropologist, American Graves Registration Service, is the author of numerous books and articles on medical, scientific, and historical subjects.

WALTHER RIESE, M.D., is Assistant Professor of Neuro-Psychiatry and Assistant Professor of the History of Medicine at the Medical College of Virginia, Richmond.

GEORGE ROSEN, M.D., Ph.D., is Professor and Head of the Department of Public Health Education at the School of Public Health of Columbia University.

JEROME M. SCHNECK, M.D., formerly on the staff of the Menninger Clinic, Topeka, Kansas, is now Clinical Associate in Psychiatry, State University College of Medicine at New York, and Director of the Mount Vernon Mental Hygiene Clinic.

DOROTHY M. SCHULLIAN, Ph.D., Curator of Rare Books, Army Medical Library, shares with Dr. Major the editing of the section on "Notes and Queries" of this Journal.

ALEXANDER P. D. THOMSON, M.B.E., is a senior Lecturer in the Department of Anatomy of the University of Birmingham, England, and for the past five years has been using the ferret in a study of the influence of environmental factors on pituitary function.

JOHN L. THORNTON, A.L.A., is Librarian of St. Bartholomew's Hospital Medical College, London, and was formerly on the staffs of University College, London, and the Wellcome Historical Medical Library. He is the author of *Medical Books, Libraries and Collectors* and several books and articles on librarianship.

Printed in the United States of America
by The Hildreth Press, Inc.
Bristol, Connecticut

Index

Abbott, A. C., 380*n*
Abernethy, John, 487, 544
Abraham, E. P., 302–17, 372*n*, 438
Ackerknecht, E. H., 68*n*, 273, 519
Adair, 206
Adam, Melchior, 176*n*, 181*n*, 184*n*
Adams, 228
Adams, James, 8
Adams, Joseph, 507
Adams, Robert, 8, 135
Adelmann, H. B., 179*n*
Adelon, 242
Addison, Thomas, 411, 505
Adrian, E. D., 449*n*
Aepli, J. M., 525*n*
Aeschylus, 489
Aesculapius, 137
Agassiz, Louis, 301
Ainsworth, 145
Albemarle, *Duke of*, 488
Albertus Magnus, 474, 476
Albinus, B. S., 6
Alcmaeon, 129
Aldrovandi, U., 474, 477, 523
Alexander *of Tralles*, 409
Alexander, H. E., 381
Alfred, 475
Aliamet, François, 8
Alibert, J. L., 82, 544
Allen, Charles, 542
Allen, Richard, 146
Alsop, Gulielma F., 549–51
Alzheimer, 444
Ampère, A. M., 90
Anderson, Gaylord, 270–1
Anderson, James, 185*n*
Andreasen, Erik, 270
Angelis, Domenico de, 409*n*
Annan, Gertrude L., 544–5
Anthony, Susan B., 549
Antommarchi, Francesco, 69, 109, 110, 250, 251, 252
Appoot, Abrahamus, 259
Arago, Jean, 90
Arbuthnot, John, 544
Archangelus, 498
Archimedes, 424
Aréjula, J. M. de, 89, 206
Ariëns Kappers, C. U., 441
Aristizabal, D. G. de, 196
Aristophanes, 471
Aristotle, 122, 129, 301, 426, 434, 435, 471, 475, 477, 478, 479, 528
Arloing, S., 60
Arnald *of Villanova*, 182*n*, 422
Arnemann, Justus, 48–52, 57
Arthur, R., 541
Arthus, 536
Artigas, José, 548
Arundel, *Earl of*, 179*n*
Asclepiades, 436
Askew, Anthony, 488, 489
Astruc, Jean, 544
Aubrey, John, 267
Audouard, M. F.-M., 244
Austin, M. F., 469
Averroes, 529
Ayrer, Melchior, 182, 183

Baas, J. H., 518
Babes, V., 293, 371
Backus, M. P., 374*n*, 392*n*
Bacon, Francis, 426, 427, 433–435, 540
Baer, K. E. von, 272
Baffoni, Aroldo, 410
Baginsky, 460*n*
Baglivi, G., 150
Baillarger, Jules, 461*n*
Baillie, Agnes, 507, 510, 513
Baillie, Dorothea, 506, 507
Baillie, Johanna, 506
Baillie, Matthew, 544
Baillie, William, 490
Bain, 467
Baiseley, 213
Baker, 312
Baker, Rachel, 239
Bakowiecki, 61
Baldaeus, Phillip, 258
Baldini, Laurentius, 502
Ballard, Thomas, 485
Bally, F. V., 68, 92, 93, 96, 97, 100, 104, 227
Bally, *Madame*, 96
Balzac, 84*n*
Banckes, Richard, 370
Bancroft, E. N., 93
Bañuelos, Manuel, 198
Baranyi, 546
Barbeck, Gottfried, 526*n*
Barbensi, G., 422
Bard, Philip, 448*n*
Barnes, Henry, 489*n*
Barnes, J. M., 174*n*
Barnett, 212, 232
Barnwell, J. B., 344, 345*n*
Baron, S. W., 428–9
Barthez, 543
Bartholin, Caspar, 498, 499, 500, 501, 502, 534, 544
Bartholin, Christoffer, 534
Bartholin, Thomas, 498, 533–4, 544
Bartolozzi, 4
Barton, *Dr.*, 12
Bary, Anton de, 292, 293
Baskerville Press, 1, 19
Bastian, 466

Bate, George, 162, 163, 165, 171
Baudens, 56
Bay, J. C., 533–4
Bayen, 276
Bayley, Richard, 213
Bazat, Pedro, 199
Bean, R. B., 549–51
Bean, W. B., 549–51
Beard, Charles, 279
Bechterew, W. von, 469
Beck, 213
Beck, J. H., 131
Beckner, W. W., 470*n*
Béclard, P.-A., 218
Bedel, Ch., 274
Beekman, Fenwick, 506–15, 537–9, 553
Behrens, J., 294
Bell, Andrew, 6*n*
Bellini, 150, 170
Belloni, Luigi, 410
Benezet, E., 8*n*
Berckhuys, Antonius, 176*n*
Berger, 449
Bergler, 469
Bergmann, E. von, 132
Bergson, Henri, 439
Bernard, Charles, 485, 486
Bernard, Francis, 483, 484, 485, 486, 488
Berthollet, 209
Berti, 119
Bertrand, J.-F.-A., 113, 114, 115, 239
Besler, Basilius, 119*n*
Besler, Hieronymus, 119
Bethe, A., 61
Bichat, M. F. X., 94*n*, 95*n*, 218, 442, 543
Biedermann, J. G., 178*n*
Bigger, J. W., 381, 382
Billings, J. S., 417
Binet, Léon, 523
Birch, Thomas, 46
Bishop, W. J., 262, 481
Black, G. V., 433
Black, Max, 138, 139
Blackwell, Elizabeth, 549, 550
Blainville, H.-M. D. de, 91
Blake, F. G., 342*n*
Blake, J. B., 412
Blakey, Nicholas, 7
Blancard, Stephen, 168
Blanche, *Mr.*, 73, 77, 78, 79
Blasius, Gerhard, 502
Block, O., 476
Bloomer, Catherine, 549
Blumenbach, J. F., 543
Bochefontaine, L. T., 468, 469*n*
Bodley, Anne, *Lady*, 482
Bodley, Rachel, 551
Bodley, *Sir* Thomas, 482, 486
Boerhaave, Herman, 99, 504, 544
Bohnhoff, M., 329*n*, 380
Bohorquez, José, 199, 205
Bolduan, Charles, 127, 128
Bonjour, Edgar, 545–7
Bontius, Jacob, 258
Boone, Henry, 486
Bordeaux, J., 493*n*
Bordeu, T. de, 94*n*
Borelli, 150
Borri, 534
Bosc, L.-A.-G., 90, 113, 247, 249
Boudi, A., Jr., 377*n*
Bouillaud, J., 446, 461*n*, 462*n*, 466
Bouillaud, J. B., 100, 242, 243, 245, 246, 250
Bouman, 459
Boussel, Patrice, 274–7
Bowditch, H. I., 24*n*
Bowditch, H. P., 140
Boxer, *Dr.*, 394
Boyer, 212
Boyer, Alexis, 95, 103
Boyle, P., 20
Boyle, Robert, 488
Boynton, E. P., 447*n*
Braconnot, 276
Bradford, 233
Bradwardine, Thomas, 424
Bramwell, J. M., 491
Brasavola, 262
Braun, Steffan, 187
Breasted, J. H., 430
Bremner, M. D. K., 430–3
Brenman, M., 493*n*
Breschet, Gilbert, 102
Breuer, 541
Bright, Richard, 411
Broca, 464, 465, 466
Brockbank, William, 261
Brodmann, K., 442
Brogniart, 231
Broussais, F. J. V., 64, 98, 99, 100, 103, 204, 206, 212, 214, 215
Brown, *Mr.*, 100, 212, 225, 241, 242
Brown, C. B., 145
Browne, Edward, 485
Browne, *Sir* Thomas, 485, 531–2
Bruce, David, 273
Brunel, Jules, 282, 287–301, 438
Brunner, Erhard, 525, 526
Brunner, J. C., 525, 526
Brunnhöfer, H., 119*n*, 121*n*
Bruno, Giordano, 116, 117, 119–24, 527–31
Bryer, Henry, 8
Buchanan, Janet, 512, 513
Buckle, N. T., 512
Bucy, P. C., 448*n*, 450*n*, 451
Budd, William, 145
Budge, 446
Büngner, O. von, 61

Buffon, *Count* de, 471, 472
Bugie, E., 322*n*, 326*n*, 377
Bunn, P. A., 316
de Bure, 490
Burmanus, Joannes, 260
Burris, R. H., 392*n*
Burton, J. H., 144
Burtt, J. B., 305
Busch, Hans, 406
Bustinza, F., 347*n*
Bute, *Lord*, 3, 4, 20
Butterfield, Herbert, 422–7

Cabanis, 232*n*
Cabrera, A., 473, 478
Caines, 220, 226, 228, 250
Cairns, *Sir* Hugh, 311, 347*n*
Callow, D., 305
Callow, R., 305
Calkins, L. A., 141
Camerarius, Joachim, the Elder, 180, 187*n*
Camerarius, Joachim, the Younger, 176–83, 188–9
Campbell, A. W., 442
Campbell, J. M., 541–2
Campbell-Renton, 303
Camus, 145
Cannon, W. B., 133
Canot, Charles, 4, 8
Canto, Matias, 199
Caraccioli, Roberto, 409
Cardano, G., 123
Cardew, George, 125–7
Carey, Matthew, 145, 196, 204, 206
Carmichael, Richard, 135
Caro, Joseph, 130–2
Carr, 158
Carrel, Alexis, 546
Carrillo, J. A. P., 205
Carter, H. E., 329*n*
Carus, C. G., 272
Carver, J. S., 383*n*
Cascellius, 432
Casearius, *Rev. Mr.*, 258
Casimir, *Pfalzgraf* Johann, 186, 187*n*
Cassá, J. LeR., 199
Casserius, Julius, 498
Castelle, 102
Castelli, Bartolommeo, 168
Cato, 371
Cattaneo, C., 305, 347*n*
Cauchy, A. L., 87, 90
Cawadias, A. P., 467
Cayol, 218
Cazier, J. LeC., 136
Celsus, A. C., 428, 544
Cerevkov, A., 469
Cesalpino, A., 122, 123*n*, 124, 544
Chabrol, 224
Chadwick, 541
Chadwick, Edwin, 128
Chaffee, E., 376*n*, 377*n*, 385*n*
Chain, Ernst, 288, 301, 302, 303, 305, 311, 312, 372*n*
Chalmers, Lionel, 273
Champollion, J. F., 69, 87, 101, 107, 209, 210, 220, 221, 223, 226, 227, 228, 244*n*
Chaptal, J. A., 90
Charaka Club, 416–17
Charas, 163
Charbonnier, 132
Charcot, 466
Chaussier, *Rev. Mr.*, 90
Chaussière, 214, 218
Chevalier, 206
Chevallier, 469
Chervin, Nicolas, 67, 68, 69, 88, 89, 92, 93, 96, 97, 100, 104, 106, 107, 113, 115, 204, 212, 233, 235, 238–40, 242*n*, 243
Chevreuil, M. E., 90, 211, 212, 216, 224, 225, 233, 234, 236, 239, 243
Chomel, A.-F., 102
Christison, *Sir* Robert, 159, 161, 162
Chroemis, K. V., 347*n*
Clagett, Marshall, 422–7
Clancy, Marguerite, 31
Clark, G., 445
Clark, R. K., Jr., 329*n*
Clark, W. E. Le Gros, 532, 533
Clarkson, *Mayor*, 146
Clay, *Mr.*, 241
Clay, Henry, 100
Clement, M., 84
Clendening, *Mrs.* Logan, 411
Cliffe, A. E., 301
Cloquet, Hippolyte, 102
Cloquet, Jules, 72, 94
Clutterbuck, P. W., 284, 302, 303
Coca, A. F., 536–7
Coghill, R. D., 285, 309, 392*n*, 393*n*
Cohen, I. B., 265–6
Cohen, R. A., 542
Cohn, A. E., 141–2
Coiter, Helena, 187
Coiter, Volcher, 176–94
Cole, F. J., 179*n*
Cole, Rufus, 416
Coleman, V. R., 382*n*
Coleridge, S. T., 532
Coles, J. O., 452
deColigny, *Admiral*, 187*n*
Colin, P. G., 392
Collard, Royer, 103
Colles, Abraham, 135
Collins, Joseph, 416, 417
Comrie, J. D., 162, 507
Condé, 187*n*

Condillac, 543
Constancia, *Mr.*, 211
Constant, Benjamin, 66, 233
Cook, 312
Cook, *Captain* James, 201, 539
Cooke, E., 305
Cooper, Richard, 5, 6
Copernicus, Nicolaus, 425, 426
Cordasco, Francesco, 544–5
Córdova, F. X. de, 199
Corner, Betsy C. (*Mrs.* George W.), 1–21, 147
Cornforth, 312
Cornil, A. V., 293
Correggio, 9
Corrigan, *Sir* D. J., 411
Corsini, Andrea, 410
Corvisart, L., 103*n*
Costales, 197
Cottle, Brooks, 23*n*
Cotugno, Domenico, 523
Count, E. W., 272–3
Courtois, Bernard, 276
Cowper, William, 487
Cozens, Alexander, 7
Craighill, Margaret, 551
Crampton, *Sir* Philip, 135
Cresswell, S. A., 305
Crile, George, 141–2
Croker-King, Samuel, 134
Crolius, *Mr.*, 87
Crowfoot, D., 312, 316
Crowley, C. G., 542
Cruikshank, W. C., 46, 47, 48, 49, 52
Cruveilhier, J. B., 113, 114
van den Cruyce, 503
Cubillas, Cristobal, 197
Cullen, William, 99, 163, 164, 200, 201, 506, 514, 544
Cullerier, A. F. A., 98
Culpeper, Nicholas, 162
Cummings, M. M., 381*n*
Currie, William, 544
Curtis, R., 326*n*
Cusanus, Nicolaus, 122
Cushing, E. H., 421
Cushing, Harvey, 186, 260, 421, 437, 490, 546
Cushing, *Mrs.* Harvey, 437
Cuvier, Georges, 90, 91, 109, 227, 239, 240, 270, 277

Dahl, R. J., 391*n*, 400
Dale, *Sir* Henry, 370
Dale, Samuel, 163
Dalmas, 227, 244
Dalmas, Huis, 102
Dalton, *Mr.*, 4
Dana, C. L., 416
Daniels, Farrington, 138, 139
Danilewsky, B., Jr., 468
Dante, 529
Darcet, 249
Daremberg, Charles, 472, 518
Darwin, Erasmus, 264
Dath, Sara, 287, 288, 299, 321
Davie, T. B., 524
Davy, *Sir* Humphry, 224, 225, 283
Dawson, M. H., 377*n*, 381*n*, 385*n*
Dawson, W. R., 429
Dealy, C., 382*n*
DeAngelis, Pietro, 525, 526
Dease, William, 134
Dee, John, 528
van Deen, 446
Defoe, Daniel, 145
Déjerine, J. J., 465*n*, 466
Delavigne, 96
De Lee, S. T., 491*n*
Delile, *Prof.*, 92
DeLint, J. G., 176*n*
Della Rovere, *Cardinal*, 496
Delmonte, 197
Delpech, J. M., 52
Demerec, M., 381
Dennistoun, James, 1*n*
De Ricci, Seymour, 484
Derosne, 276, 277
Descartes, René, 426, 439
Descot, 54
Desgenettes, N. R. D. de, 64, 101, 242, 243
Desormeaux, *Baron*, 218, 242
Desormeaux, M.-A., 102
Desperriers, 206
Desportes, 211, 213, 223, 224, 225, 242, 243, 248, 249
Destutt de Tracy, *Count* A. L. C., 232, 233, 234
Destutt de Tracy, Victor, 232
De Thou, 487
Devèze, Jean, 203, 204, 206
Dexter, J. E., 541
De Villèle, 211
Dickman, S. R., 329*n*
Diemerbroeck, Ysbrand von, 172, 501, 504
Diepgen, Paul, 543
Dietz, D. C., 377*n*
Dillon, R. H., 125–7, 147
Diodati, Charles, 547
Dioscorides, 370, 541
D'Handrel, 103
D'Hauterive, *Count*, 231
Disraeli, Isaac, 13
Dix, Charles, 72
Doebereiner, 276
Döfering, K. F. von Frank zu, 179*n*, 180*n*
Doehle, K. G., 294
Domagk, G., 372*n*
Domenichina, 9
Doolin, William, 435–6
Dorchester, *Viscount*, 267
Dorian, D. C., 547

Dorvault, 277
D'Oysel, *Baron* Hely, 213
Dreyer, 303
Droquet, 218
Dry, T. J., 139–41
Dubois, Antoine, 101
Dubois, Jacques, 275
Dubos, R. J., 305, 348, 372, 390
Duchesne, E., 295, 296
Dufrenoy, J., 392, 394*n*, 395, 397
Duffin, W. M., 312
Duggar, B. M., 378
Duhem, Pierre, 423, 424
DuLaurens, André, 497
Dulong, 237, 238, 239
Dulong, *Madame*, 237
Dumeril, 230, 239, 240
Duméril, 90
Dumont, 225, 226, 243, 249
Duncan, Andrew, Jr., 159, 161
Duncan, Andrew, Sr., 159, 161
Dundas, *Sir* Lawrence, 9
von Dungern, 536
Dupin, Charles, 88
Dupuytren, Guillaume, 64, 84, 85*n*, 94*n*, 103, 141, 218, 225, 226
Dusser de Barenne, J. G., 444, 448, 449, 469
Duthie, E. S., 317
Duveen, Denis, 262
Dyckman, *Dr.*, 88, 104

Eaton, D. B., 128
Eaton, F. A., 5*n*
Ebbell, B., 429–30
Eberhard, Wolfram, 274
Ebner, Margareth, 132
Economo, Constantin von, 442, 445
Edinger, Ludwig, 441, 443, 444
Edward III, 535
Edwards, Edward, 4, 7
Egbert, *Archbishop of York*, 473
Ehrlich, J., 378*n*
Ehrlich, Paul, 171, 384, 405, 537
Ellenbog, Ulrich, 421, 523
Eloy, N. F. J., 181*n*, 525*n*
Elton, C. I., 484
Elton, Mary, 484*n*
Emmerich, R., 295
Engels, W. H., 389, 390, 393*n*, 394
Ent, *Sir* George, 483
Erastus, Thomas, 181
Erickson, T. C., 448*n*
Erik XIV, 261
Erikson, G. E., 263–4
Esdaile, James, 491, 495
Espinosa, Mariano, 199
Esquirol, J. E. D., 73*n*
Ettinghausen, Maurice, 421
Eulenburg, M. M., 60
Euclid, 424
Eustachius, Bartholomeus, 430, 496, 497, 498, 502, 504, 544
Epson, Hendrik, 176*n*

Fabricius ab Aquapendente, 498, 544
Fackler, W. B., Jr., 381*n*
Falkenheim, H., 45, 58, 60
Falloppio, Gabriele, 498
Falk, 302
Farber, L. H., 494*n*
Farrier, P. C., 34, 37
Farrington, Benjamin, 433–5
Farquhar, 196
Fauchard, Pierre, 432
Faulkner, Barbara, 22–43, 147
Fay, Marion, 551
Fein, Rashi, 412
Feldman, W. H., 337, 339, 340, 343
Fenger, Christian, 133
Ferdinand VII, 89
Ferguson, Adam, 232*n*
Ferguson, Thomas, 143, 144
Fernández, F. A., 205
Fernel, Jean, 129
Ferrati, E., 295*n*
Ferrier, *Sir* David, 446, 468
Feti, Domenico, 9
Fichte, 517
Finlay, A. C., 378*n*
Finlay, C. J., 195, 199, 200, 203, 206, 207
Finch, Jeremiah, 531–2
Finney, John, 133
Firth, C. H., 535, 536
Fisch, M. H., 413, 415, 416, 420–2
Fischelis, R. P., 396
Fischer, Emil, 129
Fischer, Hans, 547–8
Fisher, C., 494*n*
Fisher, P., 371*n*
Fitch, *Mrs.* J. P., 29
Fitch, S. S., 541
Fizeaux, 218
Flack, Herbert, 402
Flaubert, A.-C., 72, 73, 77, 79, 80
Fleming, *Sir* Alexander, 279, 283, 284, 287, 288, 289, 297, 300, 302, 372, 374
Fletcher, C. M., 305, 372*n*
Fletcher, W. Y., 484
Florey, *Sir* Howard, 279, 283, 285, 286, 289, 293, 294*n*, 295, 296, 299, 301, 302–17, 372, 438
Florey, M. Ethel, 305, 310
Flourens, P., 55, 59, 446, 450, 452, 458
Foerster, O., 446, 447*n*
Folkers, K., 329*n*
Fontana, *Abbé* Felice, 47, 48, 49, 50, 52
Fontenelle, 426
Foot, Jessé, 512, 514
Forbes, R. J., 146
Forster, Georg, 271

Fothergill, John, 20*n*, 544
Fougeron, J., 8
Fouquier, M., 103
Fourcroy, A. F., 90*n*
Fourier, J. B. J., 90
Fourmeau, E. F. A., 276
Foville, A. L., 73, 75, 76, 77
Fox, R. H., 20*n*
Fracastoro, 523
François, M., 68
Franconi, G., 347*n*
Frank, J. P., 540
Franklin, A. L., 383*n*
Franklin, Benjamin, 246, 266, 281, 419
Franklin, K. J., 129–30
Fraser, Ian, 311
Franz, Viktor, 264
Frederic Henry, *Prince of Orange*, 14
Frederick II, 275, 476
Freeman, M. B., 370*n*
Freind, John, 150, 153, 166
French, *Dr.*, 254
Freud, Sigmund, 495, 541
Freudenreich, E., 294
Fried, J., 329*n*
Friedrich, *Bishop*, 186
Friedrich III, 185*n*
Fritsch, G., 446, 468
Frost, 145
Frost, W. D., 296
Fry, Roger, 418
Fuller, Thomas, 163, 171
Fulton, J. F., 129, 260, 281–6, 289, 301, 309, 382*n*, 411, 420–2, 437, 438, 444*n*, 446, 469, 485, 546, 552
Fuchs, W. P., 525*n*, 526*n*

Gabirol, Solomon Ibn (Avicebron), 529
Gadsden, Phyllis, 273–4
Galateo, Antonio, 408, 409
Galdston, Iago, 417–19, 435–6, 551–2
Galen, 44, 129, 428–9, 436, 496, 502, 540, 544
Galileo, 425, 426
Gall, F. J., 69, 108, 109, 243, 245, 246, 247, 251, 442, 457, 458, 466
Gallée, 102
Galloway, Alexander, 524
Galois, Evariste, 418
Garboe, Axel, 533–4
Garcia, 81
Garcia, Manuel, 419
Garcia del Real, Eduardo, 197*n*
Gardien, C.-M., 103
Gardiner, P., 305
Gardner, A. D., 305, 372*n*
Garibaldi, J. A., 383*n*
Garré, C., 293, 371
Garrison, F. H., 415, 417
Garrod, A. B., 159, 161, 162
Garrod, L. P., 375*n*, 379, 383
Gask, George, 535–6
Gasperini, G., 298
Gastelbondo, J. J. de, 197, 202
Gattini, Giuseppe, 408*n*
Gaubius, 456
Gay-Lussac, J. L., 82*n*, 224, 234, 235, 236, 237, 238, 240, 277
Genghis Khan, 476
Geoffroy St. Hilaire, 91, 92
George II, 11, 150, 487, 489
George III, 3, 16, 20, 150, 422, 490
Gerard *of Brussels*, 424
Gérardin, N. V. A., 212, 213, 223, 227, 230, 242, 249
Gerlach, J. von, 57
Gesner, Conrad, 471, 474, 476, 477, 478, 479, 523
Gilbert, R. G., 412
Gilbert, William, 426
Gill, M. M., 493*n*
Giovannelli, J. P., 525*n*
Giovanni, S., 409
Girard, Stephen, 146
Glanville, S. R. K., 429
Glisson, Francis, 501
Glister, G., 305
Goddard, P. B., 541
Goethe, J. W., 263–4, 271–2, 287, 547–8
Goldstein, Kurt, 441, 443, 455, 459, 462, 464, 466, 469, 470
Golgi, 444
Goltz, F. L., 450, 452
Goodall, Archibald, 544
Gordon, H. L., 130–2
Gosch, C. C. A., 534
Gosio, Bartolomeo, 295, 296
Gosse, Edmund, 532
Gotfredsen, Edv., 543
Graaf, Reiner de, 523
Grace, Mary, 23*n*
Graessle, O. E., 328*n*
Gratia, André, 283, 287, 288, 298, 299, 300, 321
Graunt, John, 540
Gray, E. H., 470*n*
Gray, Thomas, 12
Green, H. D., 469
Greenhill, W. A., 548
Greenwood, Major, 145
Gregory, Samuel, 549
Gridley, Selah, 135, 136
Grignion, Charles, 7
Grosvenor, G. S., 252
Gruenbaum, 459
Grünthal, Ernst, 271–2
Gubler, 469
Guenther, 57
Guerrieri, Guerriera, 408*n*
Guido, 9
Guilhon, J., 298
Guiot, *Mr.*, 248, 249

Gump, Ethel C., 23*n*
Gunnison, J. B., 382*n*
Gurlt, E., 176*n*
Guterman, Norbert, 534, 535
Guthrie, Douglas, 152*n*, 524, 525, 543
Guthrie, G. J., 53
Gutierrez, J., 383*n*
Guy de Chauliac, 44, 50, 431, 432
Guyot, Gilles, 419

Hachette, J.-N.-P., 87, 90
Haeser, Heinrich, 103*n*, 518
Haighton, J., 51, 52
Halahan, John, 134
Hales, Stephen, 419
Haller, Albrecht von, 46, 48, 176*n*, 446, 505, 517, 534
Haller, Dorothea, 179, 184*n*
Halley, Edmund, 540
Hallnagel-Jensen, O. C., 270
Hamby, W. B., 437
Hamilton, Alice, 133
Hamilton, Francis, 514
Hamilton, Robert, 514
Hamilton, Thomas, 514
Hamilton, *Sir* William, 12
Hammarberg, 442
Harris, W., 163*n*, 168
Harrison, R. G., 285, 309
Harsdörffer, Anna, 179
Hart, William, 23*n*
Harting, J. E., 472, 474, 475, 476
Hartzmann, Franz, 535
Harvey, William, 116, 117, 122, 123*n*, 129, 261, 266–7, 425, 434, 482, 483, 499, 502, 523, 533
Hastings, N., 470*n*
Hauy, *Abbé*, 232
Hay, Andrew, 8
Hayman, Francis, 7*n*
Hazlitt, William, 532
Head, *Sir* Henry, 453, 457, 458, 462, 465*n*, 466
Heatley, N. G., 285, 302, 303, 305, 309, 316, 372*n*, 375*n*
Heaton, C. E., 416–17, 419–20
Hebraeus, Leo, 123
Hecker, J. F. K., 518
Hegel, 517
Heilbron, I. M., 312
Heilman, D. H., 391*n*
Heilman, F. R., 331*n*
Heingarter, Conrad, 421
Heister, Lawrence, 544
Helmont, J. B. van, 154, 544
Helvetius, 503
Henrici, A. T., 326*n*
Henry IV, 497
Henry V, 535
Henry, R. J., 377*n*
Henschen, S. E., 466
Henslow, T. R., 31
Heraclitus, 43
Hernández, Lorenzo, 199
Herrell, W. E., 391*n*
Herrick, J. B., 132, 133
Herrick, Judson, 441
Herrlinger, Robert, 176*n*, 178*n*
Herwick, H. P., 391*n*
Hesi-Re, 432
Heubner, J. O. L., 132
Highmore, Nathaniel, 533
Hines, Marion, 447*n*
Hinshaw, H. C., 337, 339, 343, 344, 345*n*
Hippocrates, 413, 523, 540, 544
Hirsch, A., 169*n*
Hirschmann, Gerhart, 178*n*
His, Wilhelm, 62
Hitzig, Eduard, 446, 452, 453, 468
Hobby, Gladys L., 369–87, 438
Hodge, H. M., 371*n*
Hodges, Nathaniel, 150, 170
Hodgkin, J., 474
Hodgkin, Thomas, 411
Hodgson, J. E., 5*n*
Hoff, E. C., 439–70, 553
Hogarth, William, 3
Hohler, Michael, 181
Holliday, John, 196, 197, 198, 202
Holmes, O. W., 405, 419
Holmes, William, 44–63, 147
Holt, R., 305
Home, Everard, 507, 511, 514
Hooke, Robert, 426
Hookham, *Dr.*, 203
Hooper, Robert, 167
Horneck, Burkhard von, 421
Horning, E. S., 321*n*
Hornung, Joh., 119*n*
Horteloup, B., 60
Hosack, David, 65, 67, 69, 88, 104, 106, 113, 115, 229, 240, 242*n*, 243, 247
Houel, 57, 58
Howard, Henry, 179*n*
Howard, *Lord* William, 478
Howard-Jones, N., 149–75
Howell, W. H., 60, 62, 469
Huber, G. C., 60, 62
Huck, 206
Hudders, M. E., 379*n*
Humboldt, Alexander von, 237, 271, 460*n*
Hume, E. H., 267–9, 270–1
Hunter, A. C., 391*n*
Hunter, James, 507
Hunter, Janet, 512
Hunter, John, 2, 16, 17, 46, 47, 506–15, 535, 544
Hunter, Letitia U. (*Mrs.* Robert), 233
Hunter, Robert, 233

Hunter, William, 1–21, 46, 47, 48, 95*n*, 490, 506, 507, 510, 513, 514, 544
Husson, H.-M., 102, 218
Huston, John, 135
Hutchings, B. L., 383*n*
Huygens, Christiaan, 426
Huzard, 102
Hyde de Neuville, 247
Hyrtl, J., 140, 505

Ibn an-Nafis, 129
Ijichi, K., 383*n*
Imhof, Andreas, 179, 180
Imhof, Katharina, 179
Imhof, Willibald, Jr., 178
Imhof, Willibald Sr., 178, 179, 180
Imhoff, J. M., 178*n*
Inashima, James, 402
Inayat, C., 305
Isidore *of Seville*, 473, 474
Itard, J. M. G., 101
Iverson, W. P., 381

Jackson, *Gen.*, 213
Jackson, Charles, 283
Jackson, J. Hughlings, 454, *et passim*
Jackson, Samuel, 68*n*, 69*n*
Jacob, Arthur, 135
Jacobaeus, Holger, 534
Jacobsen, 145
Jacobsen, C. F., 451
Jacobson, Louis, 270
Jacquemont, Victor, 72, 216, 232
James II, 483
James, Thomas, 482
Jarvis, Edward, 127, 145
Jasper, H., 448*n*
Jaumain, 300
Jawetz, E., 382
Jefferson, *Sir* Geoffrey, 261
Jegel, August, 178*n*, 180*n*
Jenner, Edward, 144–5, 419
Jennings, M. A., 302, 305, 316, 372*n*
Johannsen, 61
Johnson, M. J., 374*n*, 392*n*
Johnson, Samuel, 46
Johnston, 441
Jones, Absalom, 146
Jones, D., 328*n*
Jordanus *de Nemore*, 424
Joubert, J. F., 384
Jugelius, *Dr.*, 180, 181
Jukes, T. H., 383*n*
Jung, Carl, 535

Kahler, 469
Kane, J. H., 378*n*
Kant, Immanuel, 439
Karelitz, Samuel, 537
Karlson, 340
Kayser, 535
Keefer, C. F., 285, 342*n*
Keill, James, 153
Keith, *Sir* Arthur, 509, 512, 514
Kell, J. F., Jr., 470*n*
Keller, G. S., 186
Kennard, Margaret A., 447*n*, 452, 469
Kennedy, R., 48
Kent, J., 305
Kepler, Johann, 116, 426
Keynes, Geoffrey, 261, 266–7, 485*n*, 490
Kerandren, P. F., 97, 100
Keys, T. E., 139
Kielmeyer, C. F., 90*n*
Kilgour, F. G., 542–3
Kingsbury, John, 128
Kiseluk, M., 379*n*
Kitteridge, *Dr.*, 254
Klaproth, 276
Klebs, A. C., 413, 414, 415, 437
Klein, D. B., 494*n*
Kleinknecht, F., 469
Kleist, 464, 466
Kline, M. V., 494
Koch, Robert, 384
Kocher, Theodor, 545–7
Koffler, H., 392*n*
Kölliker, A. von, 132
Kossiakoff, M. G., 380*n*
Koyré, Alexandre, 412, 425, 426
Kramer, H. D., 24*n*
Kremers, E., 389
Kress, Christoph II, 179, 180
Kress, Christoph III, 179
Kress, F. J., 180
Kress, G. von, 180*n*
Kroger, W. S., 491*n*
Kuehl, F. A., 329*n*
Kuni (Khuy), 432
Kussmaul, Adolf, 132, 141, 466

Lacépède, B. G. E., 270
Lacroix, S.-F., 90
Laennec, R. T. H., 78, 102, 141, 410, 523
Lafayette, *Gen.* W., 69, 86, 231, 232, 233, 234
Lagrange, J. L., 90*n*
Laight, *Miss*, 233
Lamarck, J. B. P., 264
Lamb, Charles, 532
Lamb, W. R. M., 7*n*
Lambert, S. W., 416
Lancaster, M., 305
Lancisi, G. M., 525, 526
Landois, 60
Langford, H. G., 470*n*
Laplace, 90*n*, 109, 239
Larrey, D. J., *Baron*, 53, 64, 100, 111, 215, 216, 218, 226, 242
Lasalle, *Gen.*, 215
Lashley, K. S., 445, 453*n*, 454*n*, 458
Lassis, S. L., 103

Lasteyrie, *Countess,* 233
Laugier, Stanislaus, 58, 242
Lavoisier, Laurent, 419
Lawler, John, 484
Laycock, 467
Leake, C. D., 411, 416
LeBas, 2, 6
Leblond, Sylvio, 410
Le Clerc, Daniel, 517
LeConte, *Capt.* Jno., 240, 243
Le Corbeiller, Philip, 138
LeCron, L. M., 493*n*
Le Fanu, W. R., 16
Leidy, G., 381*n*
Leigh, R. D., 27*n*
Leitkirchner, Mathes, 181
Lémery, Nicolas, 163, 275
Lemnius, L., 261
Lenard, Alexander, 496–505, 553
Lenert, T. F., 377*n*, 379*n*, 382
Lennox, *Duke of,* 267
Leonardo da Vinci, 9, 129, 261, 264, 418
Létiévant, J. J. E., 56, 58, 60
Levadie, B. T. H., 383*n*
Levy, M., 382*n*
Lewes, G. H., 467
Lewis, J. C., 383*n*
Lewis, William, 159, 160, 161
Lewisohn, Richard, 545–7
Lichtheim, 466
Licquet, Theodore, 75, 76*n*
Liepmann, 466
Lieske, R., 298, 299, 321
Liggett, R. W., 392*n*
Limousin, Stanislas, 276
Lincoln, Benjamin, 137
Lind, James, 537–9
Lindau, J. W., 268
Lindroth, S., 523
Lining, 206
Link, K. P., 297
Linnaeus, C. von, 261, 478, 479
Lipman, M. O., 377*n*
Lisfranc, Jacques, 64, 218, 219, 220, 225
Lister, Joseph, *Baron,* 57, 370
Locke, John, 465*n*
Lockwood, J. S., 342*n*, 391*n*
Löw, O., 295
Loffler, W., 347*n*
Long, C. W., 283
Long, E. R., 548
Long, P. H., 285, 342*n*
Longet, 446
Loo, Y. H., 329*n*
Lorente de Nó, Rafael, 444
Louis XVIII, 82, 91, 141
Lovell, R., 284, 302, 303
Loverdos, Gerasime de, 523
Low, *Mr.,* 96
Low, *Rabbi,* 131
Low, B. W., 312, 316
Low, David, 151*n*
Lower, Richard, 533
Lubich, V., 410
Lucretius, C. T., 527
Ludeking, W. E., 176*n*
Ludwig, *Pfalzgraf,* 185
Ludwig, Carl, 140
Lucoke, R. W., 383*n*
Lull, Raymund, 527
Lumisden, Isabella, 6
Lund, F. B., 416
Luther, H. G., 383*n*
Luther, Martin, 132
Lutoslawski, W., 119
Lyndhurst, *Lord,* 541

Macalister, Alexander, 135
McBride, Katherine E., 457
McColloch, *Col.,* 415
McCoy, E., 392*n*
McCulloch, W. S., 447*n*
McDaniel, W. B., 179*n*
McDermott, W., 387
McDonnell, J. N., 395
McGinnis, J., 383
Machiavelli, 422
McKeen, J. E., 402, 403, 404
McKegney, P., 305
McKeon, R. P., 138
McLane, C. H., 27
Maclean, Charles, 93
MacLean, L. A., 39
McMahan, J. R., 376*n*
McMahon, *Dr.,* 229
MacMichael, William, 490*n*
McMillen, W. N., 383*n*
MacPhillamy, H. B., 313
MacWilliam, J. A., 140
Madrid, J. F., 205
Magendie, François, 64, 239, 240, 446
Magnien, B.-P., 61
Magnus, Rudolf, 263–4
Maharil, *Rabbi,* 131
Maier, Anneliese, 423
Maimonides, 428
Major, R. H., 125–8, 258–62, 406–12, 523–6
Major, Thomas, 4, 7
Makittrick, 202, 205
Malcolm, L. W. G., 481
Maleuve, Pierre, 8
Malloch, Archibald, 266–7, 416
Malpighi, Marcello, 503
Mann, F. C., 337*n*, 339
Mann, *Sir* Horace, 2*n*
Mann, Thomas, 145
Manson, Patrick, 273
Marc, *Mme.,* 77, 78
Marchettis, Domenicus de, 502
Marie, Pierre, 458, 459*n*, 465*n*, 466

Marmont, A.-F.-L. Viesse de, 91
Marshall, Clara, 551
Marshall, E. K., Jr., 342*n*, 385*n*
Marshall, W. H., 448*n*
Martignac, 232
Mascagni, Paolo, 109*n*
Masdevall, José, 197
Mason, Thomas, 12*n*
Massart, J., 380*n*
Matteuci, 446
Matthaei, K. C., 93, 94
Maury, J. C. F., 541
Maxwell, Homer, 210
May, 309
Mayer, C. F., 415
Mazet, 68
Mead, Richard, 150, 165*n*, 166, 169, 170, 171, 487, 488, 489, 490
Mead, T. H., 375*n*
Mechel, 8
Meinz, 469
Mendel, G. J., 419
Mendez, J. de J., 199
Menil, 8
Merret, Christopher, 474, 478
Merton, E. S., 531–2
Méru, 187*n*
Metchnikoff, Elie, 419
Mettler, Cecilia C., 543
Metzger, H. J., 325*n*, 326*n*, 328*n*
Meyer-Abich, Adolph, 271–2
Meyer, J. C. H., 52
Meyer, K., 376*n*, 377*n*, 385*n*
Meyer, Robert, 419–20
Meynert, 442
Michael, M., Jr., 381*n*
Michaelis, C. F., 50
Michel, J. B., 90, 103
Michell, 8
Micklethwaite, *Sir* John, 483
Mill, J. S., 434
Millais, J. G., 472
Millé, F., 9
Miller, C. P., 334, 380
Miller, G. S., 472, 478*n*
Milton, John, 547
Minieri-Riccio, Camillo, 408
Mislawski, N. von, 469
Mitchell, *Dr.*, 239
Mitchell, J. K., 8, 61
Mitchell, S. Weir, 61, 145
Molière, J. B. P., 96
Molinetti, Antonio, 498, 500, 503
Monakow, Constantine von, 448, 449, 454, 455, 463, 464, 465, 466
Monge, 90*n*
Monk, *Gen.*, 489
Monro, Alexander, 6, 10, 544
Montagnana, Petrus de, 408–09
Montagu, M. F. A., 176*n*
Montefiore, *Sir* Moses, 411
Monteverde, Giulio, 144
Montoro, O., 195, 201
Moore, *Sir* Norman, 151, 158*n*, 162*n*, 164, 166, 167*n*, 481, 483*n*, 486
Mooreshead, *Sir* Owen, 16
Moreau de Jonnés, A. M., 97
Morejón, A. H., 205
Morel de Vindé, C.-G., 91
Moreno, A. R., 548
Morgagni, J. B., 442, 499, 503, 504
Morin, M., 347*n*
Morison, S. E., 265
Morley, Christopher, 536
Morton, Richard, 265
Morton, W. T. G., 283
Moseley, *Dr.*, 203
Mott, Valentine, 66, 95
Motte, B. de la, 101
Moulton, 88, 96, 100, 220, 226, 228
Moultrie, John, 200, 202, 206
Moyer, 392*n*
Müller, Johannes, 272
Müller, J. S., 7
Münzer, Hieronymus, 523
Mullen, W. J., 550
Mullett, C. F., 547
Mumford, J. G., 417
Munk, Hermann, 450, 451
Munnicks, Johannes, 259
Muralt, Wilhelm von, 525*n*
Murat, 103
Murillo, 8, 9
Murphy, J. B., 133
Murray, J. A. H., 474
Mustard, H. S., 30*n*

Nagel, Ernest, 138, 139
Nakayama, T., 268
Nakhimovskaia, M., 321
Napoleon, 53, 69, 82, 85*n*, 90*n*, 91, 95*n*, 97, 109, 110, 112, 113, 215, 216, 227, 228, 243, 246, 250, 251, 422
Nasse, 57
Naunyn, B., 132
Nehlil, J., 347*n*
Nélaton, Auguste, 58, 60
Neuburger, Max, 522
Newsholme, *Sir* Arthur, 128
Newton, *Sir* Isaac, 426, 489
Nicolaus *Cusanus*, 527
Nissl, 444
Noack, Friedrich, 526*n*
Noah, M. M., 65, 67
Norden, Heinz, 263
Norwood, W. F., 133–8, 549–51
Nothnagel, 450, 466, 469
Novak, Emil, 419–20
Numenius, 428

Nuñez, Beata, 197*n*
Nuyens, B. W. Th., 176, 180*n*, 186

Occo, Adolph, 421
Oersted, H. C., 90*n*
Ogburn, William, 138
O'Halloran, Sylvester, 134
Ohthere, 475
Oken, Lorenz, 271
Oleson, J. J., 383*n*
Olmsted, J. M. D., 129–30
Olschki, Leonardo, 530
Orfila, M. J. B., 81, 82, 83, 102, 226, 229, 230
Orr-Ewing, J., 305, 372*n*
Osborne, *Mr.*, 228, 250
Osler, *Sir* William, 64, 133, 166*n*, 415, 417, 490, 534, 551–2
Ottley, Drewry, 513
Otto, 537
Oyarvide, Roque, 199, 204

Pachon, J. F., 198, 202
Pachter, H. M., 534–5
Page, A. C., Jr., 383*n*
Pagel, J. L., 518
Pagel, Walter, 116–24, 147
Paget, *Sir* James, 58, 509, 510, 511, 514
Paget, Stephen, 507
Palgrave, 12
Palm, Georg, 182
P'an, S. Y., 378*n*
Panum, P. L., 145
Paracelsus, 181, 497, 534–5
Parchappe, J. B. M., 442, 443*n*
Paré, Ambroise, 45, 261, 544
Pariset, Etienne, 68, 69, 97, 100, *et passim*, 209, *et passim*
Parker, R. G., 369
Parkinson, James, 455, 456, 457
Parmentier, 277
Pascal, 82
Pasteur, Louis, 283, 287, 289, 291, 292, 294, 384
Pater, Walter, 532
Paterson, R. G., 419, 539–41
Paulli, J. H., 533
Paulli, Simon, 533, 534
Pazzini, A., 409, 543
Peachey, G. C., 1*n*, 6*n*, 8*n*, 16*n*, 20*n*
Peck, R. L., 329*n*
Pederson, C. S., 371*n*
Penfield, Wilder, 446
Penny, Edward, 4
Peritz, 469
Perkins, Joseph, 137
Perlman, D., 390, 404
Peterson, Frederick, 416
Peterson, W. H., 392*n*
Petit, Louis, 91
Petrucci, Thomas, 501, 502, 504
Pettenkofer, Max von, 540
Peuckert, 535
Pezuela, J. de la, 196
Pezzi, G., 409, 410
Pfister, O., 132
Pfuetze, K. H., 343*n*
Philipeaux, J.-M., 59
Philo, 428
Physick, P. S., 95
Picasso, 418
Picaza, Saturnino, 195, 199, 200*n*
Piccolomini, Archangelo, 496
Pichon, R., 347*n*
Pico della Mirandola, G., 264
Pierce, H. H., 33
Pierce, J., 383*n*
Pikula, D., 379*n*
Pilcher, L. S., 417
Pinel, Philippe, 73*n*, 90*n*, 103, 221, 247, 540, 543
Pinkston, J. O., 469
Pirckheimer, Willibald, 178, 179*n*
Pirquet, C. von, 536–7
Piso, William, 258
Pitcairn, Archibald, 487
Pitcairn, William, 490
Pitcairne, 150
Pitkin, 233
Pittis, W., 487*n*
Plashkes, S. A., 411
Plato, 434
Pliny, *the Elder*, 472, 473, 474, 475, 479
Pocock, R. I., 478*n*
Poggendorf, J. C., 48
Poinsot, 53
Poisson, S.-D., 90, 239
Pol, Nicolaus, 420–2, 523
Poole, *Maj. Gen.*, 310
Portal, Antoine, *Baron*, 83, 90, 100, 242, 243, 244, 245
Pott, Percival, 10
Pouppe-Desportes, 206
Poussin, N., 8, 9
Powell, J. H., 145, 146
Power, *Sir* D'Arcy, 481, 482, 483*n*, 490
Powle, George, 8
Poynter, F. N. L., 124
Pratt, J. H., 132, 133
Pratt, R., 369, 392, 394*n*, 395, 397
Preston, Ann, 549, 550, 551
Prévost, J. L., 54
Price, C. W., 382*n*
Priestley, Joseph, 276, 281, 544
Prince, Elmer, 23*n*
Pringle, *Sir* John, 48, 49, 206
Proskauer, Curt, 430–3, 541–2
Pugh, L. H., 325*n*
Pulvertaft, R. J. V., 311
Purkinje, J. E., 57, 141
Pye, John, 4*n*, 8*n*

Quincy, John, 149–75

Rabin, C., 408*n*
Radcliffe, John, 486, 487, 490
Raikes, H. R., 524
Raistrick, H., 284, 302, 303
Ramazzini, Bernard, 544
Ramón y Cajal, S., 61, 444
Ramsay, Allan, 3
Randall, W. A., 382*n*
Rank, Otto, 132
Ranke, 518
Ranking, J., 476
Raphael, 9
Rappaport, C. E., 525*n*
Ratcliff, J. D., 287
Ravenet, F. S., 4, 7
Ray, John, 471, 474, 478, 479, 488
Récamier, J. C. A., 218
Reddy, D. V. Subba, 258–60
Redgrave, Samuel, 8*n*
Regna, P. P., 378*n*
Reid, Thomas, 232*n*
Reil, J. C., 272, 543
Reilly, H. C., 327*n*
Reiten, P. J., 132
Rembrandt, 9
Renan, Ernest, 418
Rendall, F. G., 185*n*
Renner, Franz, 185
Renucci, S. F., 419
Reufs, F. A., 176*n*
Rey, Gregorio del, 199
Reynolds, *Sir* Joshua, 3, 5, 19, 511
Reynolds, W. M., 383
Rheede, H. A. van, 258, 259
Rhyne, William ten, 111*n*
Rice, J. L., 29*n*
Richards, A. N., 285, 286
Richerand, A.-B., 53, 94, 103, 113, 114, 225
Richet, 536
Richet, C., 60
Riese, Walther, 439–70, 553
Rinkel, Max, 407–08, 438
Rioch, D. M., 469
Riolan, Jean, *elder*, 497, 499*n*, 500
Riolan, Jean, *younger*, 499, 501
Risolia, Vicente, 548
Ritter, 142
Rizzi, G., 410
Robb-Smith, A. H. T., 532–3
Robinson, 312
Robinson, *Capt.*, 252
Robinson, H. J., 325*n*, 326*n*
Robinson, Victor, 405*n*
Robiquet, P.-J., 90, 277
Rochoux, J. A., 102
Roddis, L. H., 537–9
Rodgers, J. K., 72*n*
Roemer, M. I., 22–43, 147
Roentgen, W. C., 419
Rogers, Leonard, 273–4
Rolfinck, 523
Rolleston, George, 124*n*
Romansky, M. J., 382
Romay, Tomás, 195–208, 544
Romero, A. Suarez, 545
Rosa, Salvatore, 9
Rosen, George, 64–110, 127–8, 132–3, 138–47, 209–52, 270–4, 279–80, 411, 422, 438, 491, 516–22, 532–3, 535–6, 539–41, 543, 545, 547–8, 549, 553
Rosenau, M. J., 30*n*
Ross, A. S. C., 475
Ross, Ronald, 273
Rossini, 232
Rossolimo, 469
Rotheram, John, 159, 161
Rous, Peyton, 416
Routien, J. B., 378*n*
Roux, P. J., 95, 96, 102, 212, 226
Rowe, John, 419
Roxano, N. F., 197
Royal Academy of Art, 3, 4, 5, 7, 13, 14, 19, 20
Royston, *Lord*, 12
Rubio, Antonio, 197
Rudenberg, Rheinhold, 406
Rumphius, G. E., 259, 260
Rush, Benjamin, 105, 145, 146, 196, 201, 204, 206
Rymsdyk, Andreas van, 10
Rymsdyk, Jan van, 1–3, 6–21
Rynd, Francis, 135

Sabbadini, R., 409*n*
Sabin, F. N., 378*n*
Sachs, Bernard, 416
Saglio, Edm., 472
Sahagún, F. R., 197
Saint Bartholomew's Hospital, London, 481–90
Salgado, J. D., 197
Salicet, William of, 44, 50
Sallander, Hans, 523
Salmon, William, 162, 163, 164, 171
Sánchez, J. Lopez, 195–208, 545
Sancroft, *Archbishop*, 483
Sandby, Thomas, 4
Sanders, A. G., 302, 305, 372*n*
Santorio, Santorio, 151–6, 164
Sarpi, Paolo, 123, 124
Sarton, George, 417–19
Sauvage, 200
Sauvages, 456
Savonarola, Michele, 413
Say, J. B., 88
Scaliger, J. C., 123
Scarborough, 482
Scardeonio, Bernardino, 408
Scarpa, Antonio, 90*n*, 140
Schatz, Albert, 322*n*, 326*n*, 377, 397
Scheele, 276
Schelling, 142, 517

Schenck, Johann, 176*n*
Schiaffino, Rafael, 548
Schick, Bela, 536–7
Schierbeek, A., 176*n*
Schiff, Maurizio, 57, 450, 468
Schmid, Günther, 263, 264
Schmidt-Herrling, Eleonore, 177*n*
Schneck, J. M., 491–5, 533
Schneider, 476
Schneider, B. H., 383*n*
Schneider, E., 382*n*
Schoen, 57
Schouten, Wouter, 258
Schnitzer, S., 119*n*
Schroeder, 163
Schullian, Dorothy M., 176–94, 408–09, 413–16, 420–2, 438, 523, 525–6, 553
Schultz, *Gov.*, 255
Schuman, Henry, 263, 417, 552
Schwann, Theodor, 52, 57
Scotin, L. G., 7
Seckendorf, J. P. von, 185
Seegal, B. C., 372*n*
Seegal, D., 372*n*
Seeley, D. B., 378*n*
Séguin, 276, 277
Senn, Nicholas, 133
Sertürner, 276, 277
Seward, W. H., 65
Sharpe, 4
Shattuck, Lemuel, 127–8
Shatzky, Jacob, 130–2
Shaw, Peter, 150, 151, 158, 171, 172
Shaw, T., 473
Sheehan, Donal, 469
Shelley, H. C., 11*n*, 12*n*, 13*n*
Sherman, J. M., 371*n*
Sherrington, *Sir* Charles, 129, 446
Shippen, William, Jr., 20*n*
Shipton, J., 162
Sholes, D. M., 470*n*
Shryock, R. H., 412, 519
Shull, G. M., 378*n*
Sieburth, J. M., 383
Sigerist, H. E., 268, 519–22
Sigismund, *Duke*, 421
Sikorski, J., 132
Silcox, H. E., 392
Silveira, Diego, 199
Simmons, J. S., 143–4
Simon, John, 144
Simpson, *Sir* J. Y., 2
Sinclair, H. M., 532–3
Singer, Charles, 176*n*, 261, 408
Singer, Dorothea W., 527–31
Skell, P. S., 329*n*
Sloan, N., 448*n*
Sloane, *Sir* Hans, 11, 18, 166, 484, 488
Smillie, W. G., 25*n*, 253–7
Smith, D. E., 377*n*
Smith, D. G., 326*n*
Smith, G. Elliot, 441, 442
Smith, Genevieve, 31
Smith, H. V., 347*n*
Smith, Nathan, 136
Smith, R. W., 135
Smith, S., 312
Smith, Stephen, 128
Smith, *Sir* Sydney, 232*n*
Smith, Theobald, 537
Snell, N. S., 383*n*
Snow, John, 145
Sobral, Francisco, 197
Socrates, 531
Solleder, *Dr.*, 178*n*, 179*n*, 180*n*
Solomons, I. A., 378*n*
Sommer, F. E., 413–16
Sonnedecker, Glenn, 391*n*, 392*n*, 396
Souques, 465*n*
Spallanzani, Lazarus, 544
Spaulding, E. H., 377*n*
Spencer, Herbert, 418
Spendlove, G. A., 381
Spera, P. A., 408
Spicer, S., 382
Spieghel, Andrian van der, 498, 499, 502
Sprat, Thomas, 46
Sprengel, K. P. J., 517, 522
Spunda, 535
Spurzheim, J. C., 109
Stack, M. V., 375*n*
Stahl, G. E., 99, 525*n*
Starkenstein, E., 523
Stauffer, J. F., 374*n*, 392*n*
Stauffer, R. C., 138–9
Steindorff, George, 429–30
Steiner, W. R., 416
Steinrueck, 56
Stella, J., 9
Stensen, 533, 534
Stephen, Leslie, 532
Stephenson, E. L., 383*n*
Stern, B. J., 42*n*, 433–5
Stern, J. R., 383*n*
Stewart, Dugald, 232
Stewart, D. D., 375*n*
Stillwell, Margaret B., 413–16
Stock, F. J., 390, 391*n*, 401
Stock, P. J., 307
Stokstad, E. L. R., 383
Stone, Lucy, 549
Strabo, 472, 473, 477, 478
Strange, Robert, 1–10, 20–1
Strauss, Fritz, 271–2
Streeter, E. C., 421
Strickler, S., 469
Stromeyer, G. F. L., 132
Strong, E. W., 531
Strong, W. A., 329*n*
Struik, D. J., 265–6

Stuart, J. K., 151*n*
Stübler, Eberhard, 181*n*, 526*n*
Stukeley, *Dr.*, 12
Sturli, Adriano, 296
Sturmer, F. X., 400
Succhi, Andrea, 9
Sudhoff, Karl, 522
Swan, Joseph, 53, 63*n*
Swaneveldt, 9
Swedenborg, E., 264
Swinhoe, R., 472
Swieten, Gerard van, 202
Sydenham, Thomas, 488

Taggart, W. W., 433
Tagliacozzi, Gaspare, 523
Taylor, 471
Taylor, Stephen, 273–4
Teillard, Ania, 131
Temkin, Ousei, 138, 139
Templeman, *Dr.*, 12
Tenon, 270
Terne, Christopher, 483, 485
Thenard, *Baron*, 82, 85
Theophrastus, 181
Thillaye, *Mr.*, 229, 238*n*
Thom, Charles, 287, 297, 309
Thomas *Aquinas, Saint*, 528, 529, 530
Thomas, O., 473
Thomas, P. R., 470*n*
Thomson, A. P. D., 471–80, 553
Thomson, A. T., 159, 161, 162, 164*n*
Thomson, Elizabeth H., 437
Thomson, Samuel, 253–7
Thorndike, Lynn, 138, 139
Thornton, J. L., 481–90, 553
Thorp, F., Jr., 383*n*
Thouret, 90*n*
Ti, Huang, 267–9
Tiedemann, Friedrich, 55
Titler, *Dr.*, 203
Tomacini, 206
Tomasini, J. F., 409
Toner, J. M., 25*n*
Toppi, Nicolò, 408*n*
Tournefort, 488
Townsend, Anne, 64
Townsend, P. S., 64–115, 209–52
Townsend, Samuel, 68
Townsend, Solomon, 64
Tracy, Martha, 551
Traube, 141
Trendelenberg, F., 132
Treviranus, 142
Treveris, Peter, 370
Tripier, L., 60
Tristram, H. B., 478
Trousseau, 459, 466
Trudeau, E. L., 133
Trueta, J., 174*n*
Tryon, Thomas, 542
Tucker, Tobias, 179
Turley, H. G., 303
Turner-Jones, 316
Turner, G. T., 474
Turner, S., 474
Turner, *Sir* William, 57

Ulloa, Varela, 196
Ungar, J., 381
Unterholzen, Eustachius, 178
Urdang, George, 274–7, 388–405, 416, 438
Usaibi'a, Ibn Abi, 516

Valle, Nicolas del, 199
Valsalva, A. M., 503, 504
Vandermonde, 206
Vaudremer, A., 297, 298
Vauquelin, L.-N., 90*n*, 216, 276
Veith, Ilza, 267–9
Velasquez, 8
Velpeau, A. A. L. M., 66
Verneuil, 58, 60
Veronese, Paul, 9
Vesalius, Andreas, 129, 261, 498
Vesling, Johann, 498, 499, 500, 501, 502
Vester, J. W., 470*n*
Vézina, Charles, 410
Viborg, *Prof.*, 270
Vicary, Thomas, 535
Vidal, 73, 75, 76, 77
Viets, H. R., 407–08, 438
Villalba, 197*n*, 198
Villermé, L. R., 64, 101
Vincent, E., 305
Vinson, J. W., 378*n*
Virchow, R. L. K., 52, 57, 140, 141
Vogel, J. A., 395
Vogel, Karl, 416
Vogt, C., 445, 446
Vogt, O., 445, 446
Vollum, R. L., 347*n*
Volta, Alessandro, 90*n*
Voltaire, 503
Vuillemin, Paul, 282, 289, 290, 291, 293, 294, 371
Vulpian, A., 59, 468

Wacker, 116
Waite, F. C., 135–8
Waksman, S. A., 282, 290, 291, 292, 294, 296, 298*n*, 318–47, 370*n*, 377, 381, 397, 438
Wale, Samuel, 4
Waller, A., 57, 59
Waller, Erik, 261, 523
Walker, A. E., 469
Walker, A. M., 344, 345*n*
Wallenberg, 441
Walpole, Horace, 2
Walsh, 210

Walshe, F. M. R., 452
Walti, A., 329*n*
Walzer, R., 428–9
Ward, H. M., 294
Warden, *Mr.*, 88, 89, 91, 93, 222, 228, *et passim*
Waring, J. I., 273
Warner, Walter, 123, 124*n*
Wartburg, W. V., 476
Waterhouse, Benjamin, 265
Watkins, J. G., 493*n*
Watt, Robert, 544–5
Watts, J. W., 469
Webb, J. W., 67
Weber, Eduard, 446, 469
Weber, E. M., 383*n*
Weber, Gaspar, 186
Webster, C., 159, 161
Weed, L. H., 285
Weigel, M., 177*n*, 185*n*
Weil, E., 176*n*
Weinberger, B. W., 542
Weisenburg, Theodore, 457
Welch, Henry, 348–68, 382, 391*n*, 438
Welch, W. H., 127–8, 283
Wellcome Historical Medical Museum, 144–5, 542–3
Wells, 309
Wells, Horace, 283
Welsch, C. L., 503
Welsch, G. W., 503
Welsch, Maurice, 288, 299, 321
Wepfer, J. J., 525
Wepfer, Magdalene, 525
Wernicke, 465, 466
West, Benjamin, 20
Wharton, Thomas, 499, 500, 501
Wheatland, D. P., 265
Whipple, 128
Whipple, R. S., 523
Whitaker, T. D., 473
Whitehill, A. R., 383
Whitteridge, Gweneth, 483
Widdess, J. D. H, 133–5
Wiley, Harvey, 27
Will-Nopitsch, 176*n*
Willis, Thomas, 533
Willius, F. A., 139–41
Willughby, D., 478
Winkelmann, E., 526*n*
Winn, T. J., 404
Winslow, C.-E. A., 23*n*, 128
Winslow, J. B., 503
Wintersteiner, O., 313, 329*n*
Wirsberg, Friedrich von, 185
Wiseman, Richard, 45
Withering, William, 419
Wittwer, P. L., 183*n*
van Woerkom, 459
Woglom, W. H., 419
Wolberg, L. R., 493*n*
Wolf, Heinrich, 182, 183
Wolf, Hieronymus, 182*n*
Wolff-Eisner, 537
Wolff, P. O., 163*n*
Wolters, J., 472, 473*n*
Wolzendorff, 45
Woman's Medical College, Phila., 549–51
Wood, C. A., 416
Wood, J. G., 478
Wood, Silas, 100
Wood, W. B., Jr., 342*n*
Woodall, John, 538
Woodruff, H. B., 321*n*, 322*n*
Woodward, John, 165, 166, 167, 169
Woodward, Theodore, 136, 137
Woolett, 4
Woolf, S. J., 289
Woolsey, C. N., 448*n*
Work, E., 369*n*, 384*n*
Work, T. S., 369*n*, 384*n*
Worlidge, Thomas, 8
Wrestling, R., 296, 297
Wright, T., 474
Wundt, Wilhelm, 132
Wurz, Daniel, 45
Wycoff, John, 142

Yates, Frances A., 123*n*

Zakariya, Abu Bakr Muhammad Ibn (Rhazes), 548
Zedler, J. H., 185*n*
Zenea, A. D., 204
Zinn, 446
Zinsser, Hans, 133
Zoffany, John, 19
Zorini, A. O., 347*n*